

**FEASIBILITY OF MINDFULNESS-BASED STRESS REDUCTION FOR ADULTS
WITH AUTISM SPECTRUM DISORDER**

by

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Mindfulness-Based Stress Reduction (MBSR) is a standardized 8-week group intervention that has robust, lasting effects on improving quality of life (QOL), life satisfaction, anxiety, and stress in various disability populations (Baer, 2003). MBSR teaches individuals to cultivate awareness and inner resources to cope with life's challenges. Recent research has also found that mindfulness meditation improves attentional control and emotional regulation.

Individuals with Autism Spectrum Disorder (ASD) experience limitations in abstraction, emotion regulation, coping with stressors, and QOL. Despite potential benefits in applicable areas of challenges, MBSR has never been utilized with an ASD population. Self-report assessment outcomes can be a challenge for the ASD population due to limitations in abstraction, awareness, and flexible thinking.

Thus, this research project included two feasibility studies that examined (1) selected self-report QOL and mindfulness outcome measures and (2) a Mindfulness-Based Stress Reduction group intervention with adults diagnosed with ASD. Twenty-two subjects with ASD participated in a cognitive interview and reliability study to evaluate selected self-report measures. Subjects completed the Satisfaction with Life Scale (SWLS), Child Adolescent Mindfulness Measure (CAMM), WHOQOL-BREF, and WHOQOL-DIS at two time points with

a two-week washout period. A subset of participants ($n=8$) completed cognitive interviews with a trained counselor to evaluate the understanding of each item on the selected scales. Results support use of the SWLS and CAMM with adults with ASD, as both demonstrated good internal consistency, test-retest reliability, and item understanding.

In the subsequent quasi-experimental feasibility trial, twelve adults with ASD completed an 8-week group MBSR intervention. Intervention fidelity and feasibility standards were met for retention, understanding of material, and participation. Participants reported high satisfaction with the intervention, as measured by the CSQ-8 ($M = 27.92$, $SD = 3.5$). Participants completed an assessment battery at three time points, pre, mid, and post. Estimates of effect sizes were calculated and results indicated large effects in improved positive outlook (*partial* $\eta^2=.530$), satisfaction with life (*partial* $\eta^2=.227$), and mindfulness (*partial* $\eta^2=.233$). This project established feasibility and acceptability of a group MBSR intervention for adults with ASD while suggesting that MBSR may be an efficacious intervention for adults with ASD.

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1.0 INTRODUCTION

Mindfulness-Based Stress Reduction (MBSR) is a standardized 8-week group intervention that has robust, lasting effects on improving quality of life in various disability populations (Baer, 2003). MBSR focuses on bringing awareness to thoughts, feelings, and behaviors without attempting to change or fix impairments. This approach is uniquely applicable for rehabilitation science. Instead of focusing on impairments, MBSR teaches participants to be internally aware of expectations and reactions to unwanted challenges with an open, curious, and kind attitude (Kabat-Zin, 1985). This internal shift can ultimately enhance quality of life for people with disabilities. Despite this, few rehabilitation scientists and practitioners utilize MBSR as a viable intervention for improving the lives of people with disabilities. Chapter 2, Section 1 will (1) provide an overview of MBSR, (2) review the outcomes of MBSR, and (3) review its applicability as a rehabilitation intervention.

Individuals with Autism Spectrum Disorder (ASD) report lower quality of life than individuals without ASD (Plimey, 2007). These results are consistent across ages, cultures, countries, and measures (Plimey, 2007). Individuals with ASD experience deficits in awareness, emotional reactivity, and managing external stressors (APA, 2013). MBSR specifically targets mind-body awareness and responses to external stressors, making it uniquely applicable for ASD to improve quality of life. Chapter 2, Section 2 will (1) review the impairments experienced by

adults with ASD and (2) present MBSR as an intervention for improving QOL in an ASD population.

This dissertation project included 2 research studies. Chapter 3 will provide an overview of the research project. Chapter 4 details Research Study 1, the evaluation of self-report assessments in an adult ASD population. Several self-report assessments were selected and evaluated with a sample of twenty-two adults with ASD. Results of this study are presented in addition to a discussion of limitations. Chapter 5 reports the methodology and results of Research Study 2, a feasibility trial of a MBSR group intervention for adults with ASD. This trial evaluated the feasibility, acceptability, fidelity, and target outcomes of MBSR with a small (n=12) adult ASD sample. Results are presented along with a discussion of limitations.

Finally, Chapter 6 provides a summary of the study conclusions and implications for future research.

2.0 BACKGROUND

2.1 MINDFULNESS-BASED STRESS REDUCTION

2.1.1 Overview of MBSR

Mindfulness-Based Stress Reduction (MBSR) is a standardized 8-week program that is designed to teach participants to cultivate mindfulness, or attend to life, in the present moment, without judgment or reaction (Kabat-Zinn, 1985). MBSR was developed from a variety of traditions and scientific fields, including: dharma teachings, vipassana meditation, stress physiology, medicine, cognitive science, neuroscience, adult learning theory, and stress psychology (Kabat-Zinn, 1990; 2011). Although it may be grounded in dharma teachings, it is a secular intervention and does not include religious language or teachings. MBSR was designed as a public health initiative, to be used as a compliment to modern medicine when combating chronic stress, illness, and daily challenges (Kabat-Zinn, 2011). Since introduction in 1979, MBSR has been utilized in a variety of settings, including hospitals, medical centers, and clinics (Baer, 2003).

2.1.2 MBSR Structural Components

There are several structural components that are central to the standardized MBSR curriculum. MBSR is designed to be an 8-week intervention, including 8 weekly sessions between 2.5 and

3.5 hours and a full day (7.5 hours) silent meditation retreat after week 6. There is an orientation session and individual interview that occurs before enrollment. Homework assignments include 45 minutes of mindfulness practice a day and 5-15 minutes of informal practice for 6 days a week. MBSR is designed for a heterogeneous group and typically contains between 8 and 30 participants with a variety of disorders. In total, MBSR contains 28 hours of class time, 42 hours of homework, and an orientation session. Individual interviews or assessments occur at completion of the 8-week course. Exclusion criteria for participation in MBSR groups include: substance dependency, psychosis, suicidal ideations, and social anxiety.

Central to MBSR is that group sessions are experiential, including primarily formal meditation practices followed by group discussion and didactic presentations. MBSR includes a specific set of formal meditations taught, including: body scan, gentle hatha yoga (laying and standing), sitting meditation (breath, body, feelings, thoughts, emotions, sounds, and choiceless awareness), and walking meditation. Informal meditation practices may vary upon group but the standard include: awareness of pleasant and unpleasant events, awareness of breathing, and interpersonal communications. Group dialogue surrounding homework assignments and ways to integrate mindfulness into lives occur each week.

Each week follows a central MBSR curriculum theme. The themes progress and build upon each other throughout the 8-week course. All MBSR programs should follow the standard progression of curriculum themes. Table 1 displays the MBSR curriculum theme and formal meditation exercises for the 8-week course. Didactic presentations on stress physiology and reactivity, perception, and communication patterns provide the contextual framework to understand how mindfulness can impact coping (Santorelli, 2001a). However, the content,

didactic exercises, and activities are flexible. Teachers are encouraged to respond in the moment to the needs of the group.

Table 1. MBSR curriculum themes and formal practices by week

Week	Curriculum Theme	Formal Meditation Practice
1	There's more right with you than wrong with you. Challenges are workable.	Body Scan Sitting with focus on breath Standing yoga
2	Perception and creative responding Stress reactivity introduced	Sitting Meditation Standing Yoga Body Scan Awareness of breath Sitting meditation
3	Pleasure and power of presence (pleasant events)	Mini retreat Laying Down Yoga Walking Meditation Brief Body Scan
4	Shadow of stress (unpleasant events) Cultivating curiosity and openness Stress physiology	Standing Yoga Sitting Meditation
5	Finding space for responding -Awareness of conditioned patterns -Respond rather than reacting	Standing Yoga Sitting Meditation
6	Working with difficult situations Communication patterns	Sitting choiceless awareness, Walking meditation Yoga
7	Cultivating kindness Cultivating self-reliance	Choose preferred practices Sitting Meditation Yoga
8	A new beginning Transition to life Integration into life	Body Scan Yoga Sitting Meditation

2.1.3 MBSR Foundational Principles

Perhaps the most important foundation to the MBSR course is having qualified teachers that embody the attitudes, practice, and principles of mindfulness (McCown et al., 2011; Kabat-Zinn, 2011; Santorelli, 2001b). MBSR teachers complete rigorous training and must be deeply rooted in their own personal meditation practice (Crane et al., 2012; McCown et al., 2011; Kabat-Zinn, 2011; Santorelli, 2001b). This personal practice is the fundamental base for MBSR teaching competency. MBSR teachers are responsible for creating a safe and therapeutic environment for members to practice meditations and experientially work through personal barriers (McCown et al., 2010). The intervention is unique in that the teacher is not the expert healer or hold a power differential but guides the class to experience their own self. Thus, “the quality of MBSR as an intervention is only as good as the MBSR instructor and his or her understanding of what is required to deliver a truly mindfulness-based programme” (Kabat-Zinn, 2011, p.281).

There are seven foundational mindfulness practice attitudes that are introduced, fostered, and developed throughout the MBSR course (Kabat-Zinn, 1990). The mindfulness attitudes establish the groundwork for all meditative practice (Kabat-Zinn, 1990). These attitudes include: non-judging, patience, a beginner’s mind, trust, non-striving, acceptance, and letting go (Santorelli, 2001a). The foundational attitudes of mindfulness are embedded within the curriculum, meditations, and program. For instance, the first curriculum theme incorporates non-judging when teachers facilitate a mindful eating exercise. It is especially important for teachers to highlight these attitudes during group discussions and exercises. Together the curriculum, teacher, and participant foster and recognize these practice attitudes (Santorelli, 2001b).

2.1.3.1 Maintaining Integrity and Fidelity to MBSR

MBSR integrity is maintained by skillful, authentic, and present moment responses to context by experienced and trained teachers (McCown et al., 2011). Manualization is not appropriate for MBSR, as teachers are trained to respond in the moment rather than following a script of manualized response. Teaching attitudes and intentions must be retained (McCown et al., 2011). Teacher embodiment of the foundational mindfulness practice attitudes, presence, and a deep-rooted meditation practice are essential for the retaining the integrity of MBSR.

Thoughtful consideration should be given when changing the structural components of MBSR to meet the needs of specific populations. The mechanisms and active ingredients to MBSR have not yet been systematically identified. Thus, changes to the structure of the intervention, formal practices, foundational attitudes of mindfulness practice, or curriculum themes change the intervention from MBSR to a different intervention that will need validated.

MBSR does, however, have some flexibility in the standardized curriculum. Qualified teachers are encouraged to adapt activities and didactic material in order to meet the needs of their style and group. Fidelity to the standardized MBSR curriculum can still be retained while making small changes to the suggested group activities and didactic presentations. The standardized curriculum suggests several presentations and activities for each weekly session. However, the activities and presentations are intended to be flexible and must fit the needs of the group in that moment.

One of the greatest fidelity challenges lies in the intended heterogeneity of MBSR (Santorelli, 2001a). MBSR is specifically designed to include varying conditions and individuals (Santorelli, 2001a). Although heterogeneity is identified by Kabat-Zinn and Santorelli as a key

principle of MBSR, homogeneous populations are necessary to establish efficacy and feasibility of MBSR for certain populations.

2.1.4 Review of MBSR Literature

2.1.4.1 MBSR vs. Mindfulness-based Interventions

Mindfulness research has become increasingly popular in the last decade (Baer, 2014). Many researchers use the terms mindfulness, meditations, mind-body medicine, mindfulness-based therapy, and mindfulness-based interventions interchangeably. Further, some meta-analyses and systematic review lump these interventions together, making the effect sizes and forest plots difficult to interpret (Khoury, Lecomte, Fortin, et al., 2013). This is problematic, as not all mindfulness exercises or meditation interventions are equivalent. It is necessary to distinguish MBSR from other mindfulness-based interventions when reviewing the literature.

There are four standardized and established mindfulness interventions that are supported by a large body of scientific evidence, including: MBSR, Mindfulness-Based Cognitive Therapy (MBCT), Acceptance and Commitment Therapy (ACT), and Dialectical Behavior Therapy (DBT) (Baer, 2014). All four interventions utilize the same basic mindfulness attitudinal principles identified within MBSR (Segal, Williams, & Teasdale, 2002; Linehan, 1993; Hayes, Strosahl, & Wilson, 1999). These four interventions vary in their targeted purpose, implementation, and group design, but all remain focused on the core principle of attending to one's life mindfully in the present moment with suspended judgment (Cheisa & Malinowski, 2011).

MBCT was designed specifically for prevention of relapses in major depression by combining two established curriculums, MBSR and Cognitive Behavioral Therapy (CBT) (Segal

et al., 2002). MBCT consistently shows lasting effects in reducing anxiety and depressive symptoms in clinical populations (Gotink, Chu, Busshbach, et al., 2015). It is closely related to MBSR program in that it is also a standard 8-week program that utilizes Vipassana and Zen meditations, two hour weekly meetings, and requires homework (Cheisa & Malinowski, 2011). Specifically, MBCT and MBSR practice the same three core mindfulness meditation practices, body scan, sitting meditation, and Hatha Yoga. However, unlike MBSR, MBCT also utilizes cognitive behavioral exercises drawn from CBT (Cheisa & Malinowski, 2011; Segal et al., 2002). MBSR practices awareness of thoughts but does not engage in activities surrounding purposefully challenging or changing thought patterns. Despite these differences, MBSR and MBCT are often included together in meta-analyses and systematic reviews (Gotink et al., 2015; Gu, Strauss, Bond, & Cavanagh, 2015)

ACT is considered a group mindfulness-based intervention because it incorporates attitudes of mindfulness, acceptance, and non-judgmental reactions to unpleasant events. ACT teaches individuals to identify thoughts and feelings without attempt to control them (Baer, 2003). DBT is designed specifically for individuals with Borderline Personality Disorder. The mindfulness attitudes are incorporated into the core mindfulness module where participants practice remaining present and nonjudgmental. While ACT and DBT incorporate mindfulness attitudes, they do not include any traditional activities or meditations (Baer, 2003; Cheisa & Malinowski, 2011).

Many other researchers utilize mindfulness activities or a set of meditations in an individualized or group intervention. These specific interventions are often like MBSR or MBCT but do not incorporate the entire curriculum. This is represented in the literature with the following nomenclature: mindfulness-based intervention, mind-body skills, or mindfulness

skills. While efficacy has been established for some of these study specific interventions, they are not synonymous with MBSR, MBCT, ACT or DBT. Much of the rehabilitation research surrounding mindfulness falls within this mindfulness-based intervention category. Evidence is increasingly supporting the use of mindfulness-based interventions when MBSR is not appropriate or feasible (Khouri, 2013). However, it is typically population specific and difficult to replicate, as many of the interventions were developed specifically for that study or setting.

2.1.4.2 MBSR Outcomes

Research on MBSR has shown lasting effects in reducing symptoms of anxiety and stress in a variety of populations (Gotink et al., 2015). MBSR has also consistently shown lasting effects in improving QOL, with effect sizes ranging from small to moderate (Gotink et al., 2015). However, research indicates that MBCT or traditional CBT is more effective in reducing depressive symptoms than MBSR (Gotink et al., 2015). Further, MBSR does not show consistent changes in physical functioning or physical symptoms (Fjorback, Arendt, Fink, & Walach, 2011; Garmon, Philbrick, Becker, et al., 2013; Ledesma & Kumano, 2013). The MBSR curriculum encourages participants to cultivate mindfulness attitudes of non-striving, non-judgment, and acceptance. This impacts expectations and one's evaluation of life rather than target physical symptomology.

Gotink et al. conducted a meta-analysis of published MBSR and MBCT meta-analyses, systematic reviews, and randomized controlled trials (2015). This overview of systematic reviews and meta-analyses included 115 randomized controlled trials, using waitlist controls or treatment as usual comparisons (Gotink et al., 2015). Effect sizes and forest plots were provided, separating both by targeted outcomes and populations (Gotink et al., 2015). Results indicate that MBSR shows the greatest effects in reducing stress ($d=.51$, $p<.001$). Evidence supports MBSR

for improving outcomes in anxiety ($d=.49$, $p<.001$) and quality of life ($d=.39$, $p=.01$) as well. Populations included in this review include cancer, chronic pain, cardiovascular disease, chronic somatic disease, anxiety, mental disorders, and healthy adults (Gotink et al., 2015).

Rather than focusing on changing physical symptoms, MBSR teaches individuals to cope with life stressors, health conditions, and disabilities that often perceived as out of one's control. Researchers are finding that physical and psychological symptoms secondary to health conditions or disabilities respond well to MBSR (Fjorback, 2011; Gotink et al., 2015; Ledesma & Kumano, 2009). Thus, MBSR is being utilized in many clinical populations and showing reductions in a variety of mental health symptoms (Gotink et al., 2015; Riley & Kalichman, 2015; Zainal, Booth & Huppert, 2013).

2.1.5 MBSR as a Rehabilitation Intervention

MBSR differs from other interventions in that it does not attempt to change or fix maladaptive thought and/or behavior patterns (Baer, 2003). Instead, MBSR offers a unique approach by bringing awareness to these patterns, with an open and curious attitude (Kabat-Zinn, 1990). MBSR relies heavily on experiential learning, and awareness is cultivated through formal group meditative practices (Santorelli, 2001a). Participants are encouraged to make a lifestyle change, incorporating regular meditation practice into their daily routines even after program completion (Santorelli, 2001a). As a result, MBSR has consistently shown lasting effects on QOL (Baer, 2003; Gotink, 2015).

MBSR is increasingly used as both preventative care and treatment for a variety of illnesses (Baer, 2014; Gotnick, 2014). MBSR has been examined in populations of pain, cancer, cardiovascular disease, chronic diseases, anxiety, depression, and healthy adults (Gotink, 2015).

It appears that MBSR has been adopted by the fields of medicine, psychiatry, alternative medicine, behavioral medicine, clinical psychology, social psychology, and nursing (Gotink, 2015). However, MBSR has not yet been established as a viable intervention for rehabilitation research and practice. Individuals with disabilities experience more barriers and external stressors than those without disabilities (NOD Survey Report, 2010). MBSR specifically targets awareness and responses to stressors, making it uniquely applicable for disability populations. After reviewing 8 meta-analyses and 4 systematic reviews for a total of 449 studies, only two articles utilized MBSR in a disability population and were published in a rehabilitation journal (Azulay, 2014; Johansson et al., 2012).

The bulk of mindfulness research in rehabilitation has focused on utilizing MBSR for caregiver stress and parenting children with disabilities (Hwang & Kearney, 2014). Other researchers develop mindfulness-based interventions, utilizing a few mindfulness meditation exercises, rather than utilizing the standardized MBSR curriculum (Bedard et al., 2003; Singh, et al., 2006; 2011). Evidence to support meditation activities and mindfulness-based interventions over MBSR is limited (Goyal, Singh, Sibinga, et al., 2014). It cannot be assumed that utilizing mindfulness activities will produce the same robust outcomes as MBSR.

It is puzzling that medically oriented fields have adopted MBSR before rehabilitation scientists and practitioners. This could possibly be due to the uncertainty of how to adapt MBSR for disability populations. Another possible explanation is that there is a lack of experienced MBSR teachers in the field of rehabilitation. Regardless of the reason, MBSR should be considered a viable rehabilitation intervention for disability populations.

Rehabilitation science strives to facilitate adaptation to disability and increase an individual's functioning and participation in society (Smart, 2009; Whiteneck, 2005). Rather

than focusing on deficits or having a curative approach, rehabilitation scientists and practitioners solve problems and attempt to reduce barriers to maximum participation and quality of life (Whiteneck, 2005). Similarly, MBSR is not pathology oriented, as it does not attempt to cure or fix impairments. MBSR includes a heterogeneous sample of individuals, designed specifically to take the focus away from an individual's impairment or disability (Santorelli, 2001a). MBSR highlights self-care and promotes quality of life rather than curative techniques, which is consistent with the goals of rehabilitation. Thus, there is a need for rigorous research evaluating MBSR for disability populations in the field of rehabilitation science.

2.2 AUTISM SPECTRUM DISORDER

2.2.1 Overview of ASD

2.2.1.1 Diagnostic Criteria

Autism Spectrum Disorder is classified as a neurodevelopmental disorder characterized by (a) social communication impairments and (b) restricted, repetitive interests or behaviors (American Psychological Association, 2013). Approximately 1 in 88 individuals are diagnosed with ASD, and the United States prevalence is approaching 1% of the population. Diagnostic criteria for ASD have changed with each revision of the American Psychological Association (APA) *Diagnostic and Statistical Manual of Mental Health Disorders* (DSM) (McCrimmon, Altomare, Smith, Jitlina, Matchullis, & Sakofske, 2014). The DSM-5, recently published in 2013, has eliminated separate diagnoses of autism and instead established a unitary, umbrella diagnosis of

Autism Spectrum Disorder (APA, 2013). The following diagnoses are now considered to fall under an ASD diagnosis: infantile autism, childhood autism, Kanner's autism, high-functioning autism, atypical autism, pervasive developmental disorder, childhood disintegrative disorder, and Asperger's disorder (McCrimmon et al., 2014). Individuals with ASD are now considered to fall on a spectrum or continuum of symptom severity, characterized by severity levels. Levels include the following: Level 1: requiring support; Level 2: requiring substantial support; Level 3: requiring very substantial support (APA, 2013). Levels are determined separately for (a) social communication deficits and (b) restrictive, repetitive interests.

2.2.1.2 Functional Limitations

Individuals with ASD have difficulty interpreting social situations and responding with behaviors consistent with societal norms (McCrimmon et al., 2014). Social impairments can consist of a lack of social reciprocity, or failure to hold mutual back and forth conversations. Individuals with ASD are thought to have deficits related to theory of mind, or recognizing and understanding the mental states of another person (McCrimmon et al., 2014). Further, individuals with ASD often have deficits in verbal and nonverbal communication. Communication impairments can consist of language delays, overly literal speech, abnormalities in eye contact and body language, and lack of facial expressions or flat affect (APA, 2013; McCrimmon et al., 2014).

Individuals with ASD have lower reported QOL than individuals without ASD. These results are consistent across ages, cultures, countries, and measures. Specific domains implicated in this difference include: social functioning, health, relationships, and sexual relationships (Plimey, 2007). Chiang & Wineman found that behavior problems and leisure activities were

significantly associated with QOL scores (2014). Thus, limitations in communication and social functioning are reflected in life satisfaction, outlook, and QOL.

Cognitive rehabilitation and social skills interventions target these deficits but generalizing these skills in novel situations is difficult (McCrimmon et al., 2014). These limitations in social reciprocity, theory of mind, and communication make it very difficult for individuals with ASD to initiate and maintain social relationships (McCrimmon et al., 2014; Myles & Simpson, 2002). However, individuals with ASD still desire to have meaningful relationships with family, peers, and significant others (Myles & Simpson, 2002). This incongruence explains a widespread dissatisfaction with social, familial and romantic relationships reported by individuals with ASD (van Heijst & Guerts, 2015).

The second category of diagnostic criteria consists of restricted, repetitive patterns of behaviors, interests, or activities (APA, 2013). Individuals with ASD often have a restricted set of interests that are pursued with an intensity or fixation that is not consistent with peers (Myles & Simpson, 2002). ASD is also characterized by repetitive behaviors, such as self-stimulating movements, and hypo- or hyper-sensitivity to sensory stimuli (McCrimmon et al., 2014). Some individuals are indifferent to typical painful stimuli (hypo) while others find discomfort in ordinary textures, lights or sounds (hyper) (McCrimmon et al., 2014).

ASD is also characterized by numerous executive functioning impairments (McCrimmon et al., 2014). Specifically, cognitive flexibility, attention, planning, impulsivity, and emotion regulation are impacted (McCrimmon et al., 2014). A hallmark symptom of ASD is inflexibility with change, and individuals with ASD often experience extreme distress with small changes (APA, 2013). Shifting attention away from a special interest topic or activity is challenging. Similarly, maintaining attention on topics other than fixated interest is difficult for individuals

with ASD (APA, 2013). Individuals with ASD also experience cognitive deficits in language processing and abstract reasoning (Minshew, Meyer, & Goldstein, 2002 ;Williams, Cherkassky, Mason, Keller, Minshew, & Just, 2013).

Many of these impairments associated with ASD are complicated by a lack of self-awareness (Rieffe, Terwogt, & Kotronopoulou, 2006). Inaccurate error prediction suggests a lack of awareness needed for performance monitoring (Verhoeven, Marijnissen, Berger, Oudshoorn, van der Sijde, & Teunisse, 2011). However, research suggests that this lack of awareness is not simply related to performance monitoring but also identification of thoughts and feelings (Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007). Individuals with ASD have difficulty reporting or describing their feelings in relation to emotional stimulation (Lombardo et al., 2007; Rieffe et al., 2007). This deficit in self-referential cognition impacts not only social interactions but also functional outcomes, such as transitioning to employment. Further, it poses challenges for any individual or cognitive psychotherapy.

Biological deficits in abstract reasoning, language processing, and awareness produce challenges for research with this population (Minshew et al., 2002; Lombardo et al., 2007; Williams et al., 2013). Specifically, self-report assessment in this population is complicated by the ability to interpret language, abstraction, and generalization of items to self. Proxy assessments are available for caregivers and parents with younger populations. However, they may not be appropriate for research with adults (Carr et al., 2003; Chiang & Wineman, 2014; Plimley, 2007; van Heijst & Guerts, 2015). Thus, researchers must consider these cognitive impairments when choosing self-report outcome measures.

2.2.1.3 Comorbidity

It is common for an individual with ASD to have comorbid diagnoses. Comorbid intellectual disability is the most common secondary diagnosis, characterized by an IQ of less than 70 (McCrimmon et al., 2014; Trammell, Wilcynski, Dale, & McIntosh, 2013). Epilepsy and tic disorders are also prevalent in the ASD population (McCrimmon et al., 2014). Comorbid mood disorders include the following: specific phobia, obsessive-compulsive disorder, attention-deficit/hyperactivity disorder, oppositional defiant disorder, depression, generalized anxiety disorder, and separation anxiety disorder (McCrimmon et al., 2014). Many of individuals with ASD have deficits in emotional regulation and stress tolerance, which contributes to the inability to process complex social and emotional situations (APA, 2013; McCrimmon et al., 2014). This ultimately contributes to the presence of depression or anxiety disorders.

It is common for individuals with ASD to experience symptoms of anxiety without warranting a comorbid anxiety disorder diagnosis (Trammell et al., 2013). It is suggested that symptoms of anxiety or depression are interpreted in context with the primary limitations of ASD (Trammell et al., 2013). In fact, a social anxiety diagnosis is not to be made comorbid with an ASD diagnosis. (APA, 2013). Symptoms of anxiety are common during social situations given the social and communication deficits characteristic of ASD (Trammell et al., 2013).

2.2.2 MBSR and ASD

To date, there are no research studies that have evaluated or are currently evaluating the efficacy of MBSR improving outcomes for adults diagnosed with ASD (Clinical Trials, 2016). The mindfulness research related to ASD populations surrounds mindful parenting techniques for parents of children with ASD (Hwang, Kearney, Klieve, Lang, & Roberts, 2015). There is one

published randomized controlled trial that utilized MBCT in an adult ASD population (Spek, 2013). A quasi-experimental study was conducted evaluating the efficacy of ACT for adolescents with high functioning ASD (Pahnke, Lundgren, Hursti, & Hurvikoski, 2014). However, this intervention was implemented in the high school with special education teachers (Pahnke et al., 2014). Finally, there have been few published studies that utilized single mindfulness exercises to improve outcomes for individuals with ASD (Hwang & Kearney, 2013; Singh et al., 2011; Singh et al., 2006).

Spek et al. adapted the MBCT curriculum to meet the needs of an adult ASD population (2013). This randomized controlled trial assigned participants ($n=42$) to an intervention or wait-list control group. The adapted intervention, titled MBT-AS, consisted of nine sessions, each lasting 2.5 hours in length. The intervention was developed to target comorbid anxiety and depression symptoms in ASD. Adaptations were made for identification of thoughts, use of metaphors, and additional time for processing. Daily homework was required by participants. Given the aim of this study, MBCT was more appropriate than MBSR, as MBSR does not show robust effects in reducing depression symptoms (Gotink et al., 2015). Results indicated significant group x time interactions for all outcomes. Effect sizes comparing groups were large for depression ($d=.78$), anxiety ($d=.76$), and rumination ($d=1.25$) (Spek et al., 2013). Mediation analyses indicated that rumination mediated the effects on anxiety but not depression (Spek et al., 2013). This randomized controlled trial is the most similar mindfulness-based group intervention model to this present study.

Mindfulness-based interventions have been developed to reduce unwanted aggressive behaviors in individuals diagnosed with Autism Spectrum Disorder (Singh et al., 2011; Singh et al., 2006). These interventions only utilize with a few meditation exercises, often taught to

parents to implement with children. These mindfulness interventions varied in design and implementation, but many utilized the informal mindfulness exercise of ‘Meditation on the Soles of the Feet’. For this exercise, individuals shift their attention to a neutral body part (soles of feet) when they are experiencing intense emotional reactions to something. All of these studies found reported aggressive behaviors to be significantly reduced following mastery of the Meditation on the Soles of the Feet exercise (Harper et al., 2013; Hwang & Kearney, 2013; Singh et al., 2011; Singh et al., 2006). However, it should be noted that this mindfulness exercise was used in isolation from the rest of the MBSR curriculum. Consistent with much ASD research, these studies included sample sizes of 6 or less, implemented on an individual basis instead of a group setting. Further, researchers trained parents or family members of children with ASD to implement the mindfulness exercises. Despite these limitations, these studies demonstrate that mindfulness exercises have the potential to be an efficacious intervention for improving emotional regulation in individuals with ASD.

2.2.2.1 Previous Work

Previous work utilizing an MBSR-like intervention has been piloted for over a year with approximately 45 transition-aged young adults with cognitive disabilities (Beck, 2014; PRO16100106). This program consisted of 12 weekly 1-hour sessions. Meditations included a shortened body scan, mindful check-in, walking meditation, and mindful movement Hatha yoga. The loving kindness meditation was not introduced to the group. Didactic presentations included the mindfulness triangle of awareness to assist participants in identification of body sensations, thoughts, and emotions. Activities surrounding communication patterns were not successful given the social impairments experienced by individuals with cognitive disabilities. Participants responded best to consistent structure during each session. For instance, the participants expected

to begin with the mindful check-in followed by a one-word sharing of experience. New material was then introduced followed by a longer meditation. Participants required additional explanations of homework assignments and structuring time to complete meditations.

The results of this pilot work found small effect sizes for within subjects repeated measures ANOVA in anxiety (*partial* $\eta^2 = .059$), mindfulness (*partial* $\eta^2 = .043$), and life satisfaction (*partial* $\eta^2 = .07$). However, this pilot work lacked methodological rigor, as it was embedded within a larger rehabilitation program with additional interventions. Further, the sample included a range of cognitive disabilities rather than a homogenous sample of participants diagnosed with ASD.

2.3 SUMMARY

MBSR is an 8-week group intervention that utilizes mindfulness meditation practice to teach participants to cope with challenges and live in the present moment, non-judgmentally (Kabat-Zin, 1985). MBSR has been shown to improve life satisfaction, QOL, stress, and anxiety for individuals in a variety of populations (Gotink et al., 2015). MBSR teaches individuals to cultivate awareness of stressors, emotions, thoughts, and reactions.

Individuals with ASD have deficits in self-awareness, emotion regulation, and report significantly lower QOL than same-aged peers without disabilities (Kessler, 2010; van Heijst & Guerts, 2015). Further, deficits in executive functioning contribute to difficulty managing external stressors. Self-report assessment completion in this population are complicated by challenges with awareness, abstraction, and language comprehension. Few self-report assessments are validated in this specific clinical population. This causes challenges for

researchers evaluating outcomes of psychosocial interventions in the population, as participants may be incorrectly completing scales or misinterpreting items.

MBSR has been embraced as evidence-based practice for preventative care and improving mental health outcomes in the fields of medicine, psychiatry, alternative medicine, behavioral medicine, clinical psychology, social psychology, and nursing (Gotink et al., 2015). Yet, it has yet to be considered a viable intervention by rehabilitation researchers and practitioners. MBSR embraces rehabilitation science philosophy, as it does not attempt to change or fix a person's impairments but instead has a functional approach to self-care and coping with life's challenges (Smart, 2008; Whiteneck, 2005). MBSR specifically targets mind-body awareness and responses to stressors, making it uniquely applicable for ASD to potentially improve QOL and satisfaction.

Thus, this research project included two feasibility projects to (1) evaluate self-report outcome measures and (2) utilize an 8-week MBSR group intervention for adults diagnosed with ASD. Chapter 3 provides the further rationale and an overview of the research projects.

3.0 RESEARCH PLAN

3.1 RATIONALE AND SIGNIFICANCE

Mindfulness interventions offer a unique approach by focusing on awareness of thoughts, feelings, and behaviors rather than attempting to changing them. Further, MBSR has consistently shown lasting effects on quality of life and well-being (Baer, 2003). Although there is some evidence suggesting that mindfulness practices may benefit adults with ASD, no studies have evaluated MBSR (Singh, 2011; Spec et al., 2013). MBSR is a well-validated group intervention that has been shown to improve satisfaction and quality of life (Baer, 2003).

There are very few available self-report psychological instruments that have been validated with adult ASD samples (Trammell et al., 2013). This poses a problem for evaluating the efficacy of new treatment modalities. Thus, this project evaluates the quality, understanding, and reliability of QOL and mindfulness self-report assessments with a sample of adults diagnosed with ASD.

This project offers several significant advances to the fields of rehabilitation science: (1) This project is the first and only research study to examine MBSR for individuals with ASD; (2) The field of rehabilitation science has yet to consistently embrace mindfulness practices as viable interventions. This study will rigorously evaluate the feasibility of MBSR for a rehabilitation population while retaining fidelity to MBSR. (3) There is a dearth of self-report assessments

validated with ASD populations. This study will add to understanding of appropriate self-report measures for adults with ASD.

3.2 OVERVIEW OF RESEARCH STUDIES

This research study includes two research projects, including (Research Project 1) the evaluation of selected measures with adults diagnosed with ASD and (Research Project 2) a feasibility trial of MBSR for adults diagnosed with ASD. The evaluated measures from Research Project 1 were utilized as outcome measures in the subsequent feasibility trial (Research Project 2). Figure 2 provides a visual overview of the research project.

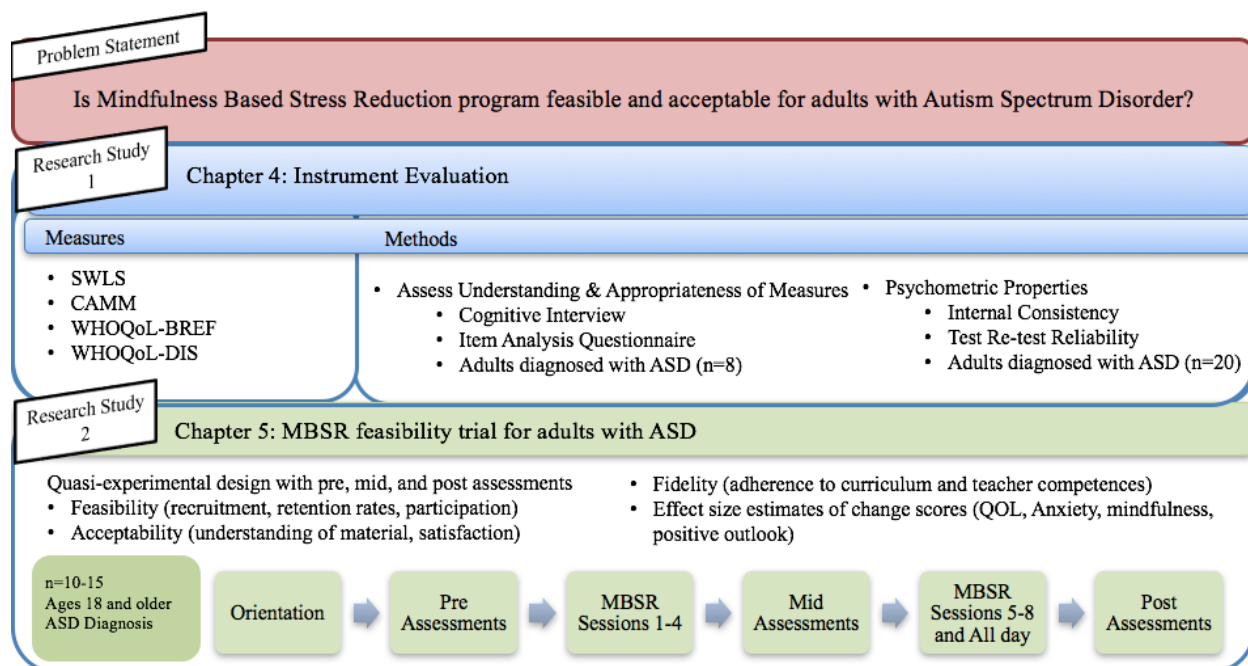


Figure 1. Overview of project studies and methodology

3.2.1 Research Project 1: Evaluating Self-Report Assessment in ASD

Chapter 4 includes the methodology, analytic plan, and results of the evaluation of several self-report measures with an adult ASD population. Selected scales target the following constructs: QOL, satisfaction, and mindfulness. The understanding of items in selected measures were qualitatively evaluated through a cognitive interview protocol. Understanding was assessed with an item analysis scale (Appendix A). Internal consistency was evaluated to assess if items reliably assess the same construct. Finally, test retest reliability was evaluated at 2 weeks. Table 2 below delineates the intended aims and research questions for evaluating self-report assessment

in ASD. The study aimed to identify an appropriate self-report quality of life and mindfulness measure for use with adults diagnosed with ASD.

Table 2. Research study 1 aims and research questions

Aim	Research Questions
Identify an appropriate mindfulness and quality of life self-report measure for use with adult ASD population.	<p>Does each instrument establish understanding (agreement $\geq 75\%$)?</p> <p>Does each instrument demonstrate internal consistency ($\alpha \geq .8$)?</p> <p>Does each instrument demonstrate test-retest reliability ($ICC \geq .75$)?</p>

3.2.2 Research Project 2: MBSR feasibility trial for adults with ASD

Chapter 5 addresses the methodology and analytic plan for the MBSR randomized controlled trial. There were three aims to this study, including (1) to establish feasibility and acceptability of a MBSR intervention for individuals with ASD; (2) maintain fidelity and teaching competency of MBSR while utilizing the ASD population; (3) to calculate effect size estimates on changes in targeted self-report outcomes. Adults diagnosed with ASD were recruited to participate in an 8-week MBSR group intervention. Participants completed an assessment battery at three time points. Statistical analyses considered descriptive statistics, frequency rates, and effect sizes (partial η^2), reporting on within group changes across time. Table 3 below delineates the aims and research questions of the feasibility trial.

Table 3: MBSR feasibility trial study aims and research questions

Aim	Research Questions
Establish feasibility and acceptability of an 8-week group MBSR intervention in ASD population.	Will 85% of participants attend 5 of the 8-weekly group MBSR sessions? Will 80% of enrolled participants receive understanding scores (2 or higher) for 85% of the sessions?
Maintain fidelity and integrity of MBSR while utilizing with ASD population.	Did the teacher demonstrate overall teaching competency by the MBI-TAC standards?
Calculate effect size estimates on changes in targeted self-report outcomes.	Is there a significant difference in outcome scores averaged across time points?

4.0 RESEARCH STUDY 1: EVALUATING SELF-REPORT ASSESSMENT IN ASD

This research study evaluated the stability and item wording of several self-report assessments with adults diagnosed with ASD. The study aimed to identify an appropriate self-report quality of life and mindfulness measure for use with adults diagnosed with ASD.

4.1 METHODOLOGY

4.1.1 Design and Overall Study Approach

This project utilized a mixed methods test-retest design to explore the item understanding and psychometric stability of selected self-report assessments in an adult ASD population. This study was approved by the University of Pittsburgh Institutional Review Board (PRO16050352). The study included two phases of data collection. In the first phase, research subjects completed the assessment battery at two timepoints with a washout period of two weeks. This study aimed to identify an appropriate quality of life measure for adults with ASD. A subset of subjects completed a cognitive interview to evaluate the understanding of every item on each assessment. However, one of the quality of life measures did not pass standards for item understanding during phase 1. Thus, the study was continued to test the item understanding and psychometric stability of a different version of the inappropriate quality of life measure (Phase 2). Phase 2

consisted of evaluating another, less complex version of the same quality of life measure utilizing the same methodology. Figure 3 below depicts the study methodology for each phase.

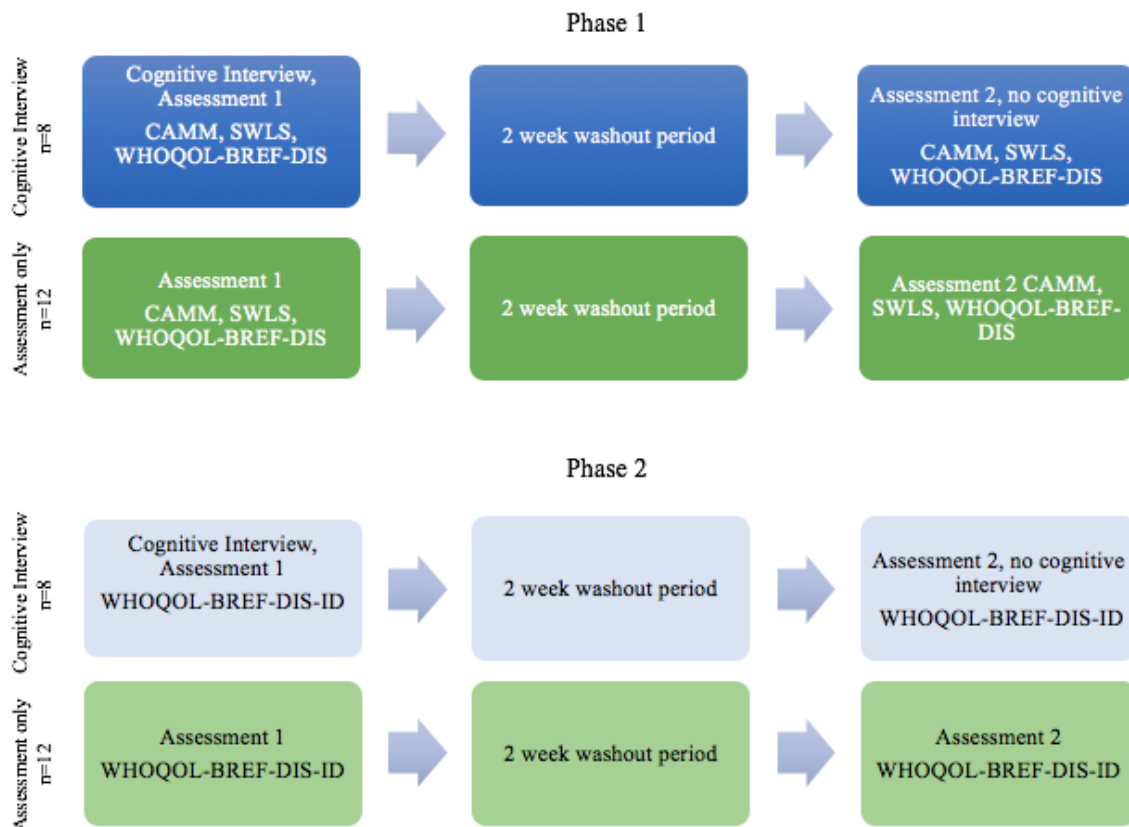


Figure 2. Research study 1 methodological design

Both phases of this study included 20 adults diagnosed with ASD. Potential eligible subjects were identified from a residential vocational rehabilitation facility and approached for interest in the study. Interested subjects were screened for eligibility criteria. Enrolled subjects consented to complete a battery of assessments with a research assistant at two timepoints (assessment only

group). A subset of subjects (n=8) consented to complete a cognitive interview for the first assessment battery followed by completing the assessment battery again at 2 weeks (cognitive interview group). Subjects were compensated \$10 for their participation in each phase of the study. The cognitive interview and assessment only groups were compensated the same amount.

4.1.2 Participants and Eligibility

Twenty-two subjects were included in this study due to sample size estimates for test-retest reliability (Shoukri, Asyali, & Doner, 2004). Subjects consisted of a convenience sample of students attending a state-run vocational facility for individuals with disabilities, the Hiram G. Andrews Center. Potential research subjects were identified from the Hiram G. Andrews Center (HGAC). Subjects were approached with the opportunity to participate in this research study. Participation in this study did not impact subjects' clinical and vocational interventions at the center. Upon consenting to enroll in the study, subjects' public vocational rehabilitation case files were reviewed to ensure basic eligibility criteria.

Inclusion Criteria: Research subjects had a documented primary disability code of Autism Spectrum Disorder, Pervasive Developmental Disorder, or Asperger's Disorder, as listed in their public vocational rehabilitation case folder.

Exclusion Criteria:

- Receiving a therapeutic intervention at the time of the study due to the test-retest design.
- Intellectual Disability diagnosis or full scale IQ score <70 (WAIS III, WAIS IV, MAB, K-BIT). This research intended to target individuals with generally intact verbal and abstract abilities.
- Verbal intelligence scores <75 (WAIS III, VIQ; WAIS IV, VCI; MAB, V; K-BIT, V)

- WAIS III or WAIS IV Similarities Score ≤ 5
- Unwilling to fully participate or disinterested in the research study.

Phase 1 consisted of twenty eligible subjects. The same twenty subjects were approached for phase 2 of the study. Two subjects from phase 1 were no longer residing at the facility. Thus, two additional subjects were identified, screened, and consented to participate in phase 2 (total n = 22).

4.1.3 Procedure

All subjects (n=20) received the assessment battery at two time points (baseline and 2 weeks). The same research assistants administered the assessments to all subjects at all timepoints to ensure standardization. Following completion of the second assessment battery, subjects received \$10 compensation.

The assessment only group (n=12) of the sample completed the assessment battery twice with assistance from a research staff member as needed. Subjects were given the choice to complete the assessment battery online via Qualtrics or on paper.

Eight of the twenty subjects completed a cognitive interview with an interviewer during baseline assessments (Lawshe, 1975). The same interviewer conducted all cognitive interviews and was a master's level clinician Certified Rehabilitation Counselor with over 5 years of experience working with adults with Autism Spectrum Disorder. The cognitive interview consisted of the subject being asked to "think aloud" while completing the questionnaire (Greco, Yu, Johnston, Dodds, Morone, Glick, Schneider, Klem, McFarland, Lawrence, Colditz, Maihoefer, Jonas, Ryan, & Pilkonis, 2015). Specifically, subjects were asked to read the

question, reword the question into their own words, and explain their answer choice. Subjects were asked to comment and circle any confusing item wording. The interviewer also prompted the subject on item confusion when the subject stumbled over reading the question aloud. The interviewer recorded comments made during each assessment. Specifically, the interviewer recorded instances where the subject's answer suggested misinterpretation or confusion of the item wording. The subjects completed the Item Analysis Questionnaire at the end of each single assessment in the battery (Appendix A). All cognitive interviews were audio recorded and transcribed.

Phase 2 consisted of the same methodology for both the assessment only sample (n=12) and cognitive interview sample (n=8).

4.1.4 Measures

The following measures were selected for preliminary validation: SWLS, CAMM, WHOQOL-BREF, and WHOQOL-BREF-DIS. Phase 2 evaluated a revised version of the WHOQOL-BREF, the WHOQOL-BREF-ID and WHOQOL-BREF-DIS-ID. Measures were selected based on their relevance to the aims of Research Project 2: the MBSR feasibility trial for adults with ASD.

Previous studies and clinical work have indicated that the standard adult measures of mindfulness, the Mindfulness Attention Awareness Scale (MAAS) and Kentucky Inventory of Mindfulness Scale (KIMS), were inappropriate for adults with ASD (Beck, Schutte, Sporer, McCue, 2014; PRO16100106). Specifically, participants had difficulty interpreting a few of the items due to concrete interpretations of wording. The MAAS, item 7, reference 'automatic pilot' or 'running on automatic' which was frequently problematic for participants. The MAAS also includes an item that references driving, which is not applicable to many adults with ASD.

Finally, the item that assesses active listening used phrasing that was confusing as well: “listening with one ear”. Subsequently, the KIMS was used as an outcome measure in program evaluation for a mindfulness skills group (PRO16100106). Participants found the KIMS to be cumbersome, as it includes 39 items. The items on the KIMS were less confusing to participants, but it includes a subscale related to describing internal states. This is a hallmark limitation of ASD. Thus, it was causing problematic results, as participants have difficulty describing internal states due to cognitive deficits instead of low mindfulness. It also includes items that relate to sensory sensitivity in ASD, “noticing smells and aromas”. Thus, the measure wasn’t assessing mindfulness as intended with this population.

Thus, a comprehensive review of mindfulness measures was conducted. The review included the following measures: Child Adolescent Mindfulness Measure (CAMM), Cognitive and Affective Mindfulness Scale-Revised (CAMS-R), Daily Mindful Responding Scale (DMRS), Five Facet Mindfulness Questionnaire (FFMQ), Freiburg Mindfulness Inventory (FMI), KIMS, MAAS, Mindfulness Breath Attention Scale (MBAS), Philadelphia Mindfulness Scale (PHLMS), Self-Compassion Scale, and the Toronto Mindfulness Scale (TMS) were considered as potential mindfulness measures. Reliability and validity statistics were reviewed for all measures. These measures were selected based upon a review involving two experts in the field of Autism Spectrum Disorder (Licensed Neuropsychologist and Licensed Professional Counselor). The measures were appraised by item for item confusion, appropriate wording, and applicability to the population by the expert reviewers.

Two measures were included in Research Project 2 that were not evaluated in this study: NeuroQOL-Anxiety Short Form and HEAL Positive Outlook scale. These scales were reviewed by ASD experts and the item wording appeared to be appropriate for this population.

4.1.4.1 Item Analysis Questionnaire

The Item Analysis Questionnaire was developed for this study (Appendix A). The scale contains two items to evaluate item understanding. The items include “the questions were easy to understand” and “the wording of the questions made sense to me”. This scale was used to quantify agreement related to item understanding.

4.1.4.2 Satisfaction with Life Scale (SWLS)

The SWLS is a global measure of satisfaction with quality of life and well-being. The SWLS has five items asking participants to self-report their holistic well-being. This scale reports a reliability alpha coefficient of .87 at the time of the assessment and an alpha coefficient of .82 two months following the original assessment (Diener, Robert, Larsen, Griffin, 1985). This measure was validated in undergraduate and elderly populations. These 5 items are ranked on a 7-point Likert scale and are summed for a total score of life satisfaction (Diener, et al., 1985).

4.1.4.3 Child and Adolescent Mindfulness Measure (CAMM)

The CAMM is a ten-item single factor scale to measure mindfulness (Greco, Baer, & Smith, 2015). The CAMM includes items related to multiple facets of mindfulness, including observing, acting with awareness, and accepting without judgment (Greco et al., 2015). The CAMM differs from the MAAS and KIMS, as it does not include items related to describing internal experiences into words due to developmental cognitive capacity of adolescents (Greco et al., 2015). Items on the CAMM are summed for a total score, ranging from 0-40. The scale has demonstrated internal consistency ($\alpha=.80$ and $\alpha=.84$) (Greco et al., 2015; Kuby, McLean, & Allen, 2015). The measure was validated with a normal population of children and adolescents, grades 5-10, and mean age of 12.5.

4.1.4.4 WHOQOL-BREF and WHOQOL-BREF-ID

The WHOQoL is an internationally developed global QOL measure that aims to be applicable across countries and cultures (The WHOQOL Group, 1995). This measure attempts to take a general well-being approach instead of a deficit or medical approach (The WHOQOL Group, 1995). It is designed to be a subjective measure and attempts to capture one's perception of QOL (The WHOQOL Group, 1995). The full version of the WHOQoL includes 280 items and 6 domains. There are shortened versions of the WHOQoL, the WHOQOL-100 (100 items) and WHOQOL-BREF (25 items). The WHOQOL-100 and WHOQOL-BREF were translated and validated in over 40 countries (Carr, 2003).

The WHOQOL-BREF consists of 26 items and four domains: physical health, psychological, social relationships, and environment. It was developed and tested in a global field trial, consisting of twenty field trials in eighteen countries (The WHOQOL Group, 1996). It contains one question from each of the 24 domains in the WHOQOL and two global or overall quality of life measures (The WHOQOL Group, 1996). Subsequently, the WHOQOL-BREF conducted a trial to test the psychometric properties in 24 centers across 23 countries ($n = 11,380$). This scale reported a reliability alpha coefficients across domains ($\alpha = .82$, physical health; $\alpha = .81$, psychological; $\alpha = .80$, environment; $\alpha = .68$, social relationships) (Skevington, Lofty, & Connell, 2004). This measure was evaluated with adults aged 12 -97 ($M = 45$, $SD = 16$) (Skevington et al., 2004).

The WHOQOL-DIS work group created a simplified version of the WHOQOL-BREF for individuals with intellectual disabilities, WHOQOL-BREF-ID (The WHOQOL-DIS Group, 2011). This version contains the same root items but with simpler phrasing. For instance, item 3 evaluates physical pain interference. THE WHOQOL-BREF states "To what extent do you feel

that (physical) pain prevents you from doing what you need to do”. The WHOQOL-BREF-ID states “Does (physical) pain stop you from doing what you need to do?” The WHOQOL-BREF-ID also utilizes a 3-point response scale rather than the traditional 5-point scale (Fang, Fleck, Green, McVilly, Hao, Tan, Power, 2011). Internal consistency of the WHOQOL-BREF-ID was evaluated using Chronbach’s alpha by subscale ($\alpha = .705$, physical health; $\alpha = .759$, psychological; $\alpha = .792$, environment; $\alpha = .606$, social relationships). The WHOQOL-BREF-ID proved to be more appropriate for study given the findings from Phase 1. This scale was used with permission from the originating author (Powers, 2011). However, the 5-point scale option was used in the WHOQOL-BREF-ID, as cognitive interview participants reported to prefer the 5-point scale and this allowed for greater variability in psychometric analyses.

4.1.4.5 WHOQOL-DIS and WHOQOL-DIS-ID

Subsequent WHOQoL work groups sought to identify whether the WHOQoL was appropriate for individuals with physical and intellectual disabilities (Power & Green, 2010). The WHOQOL disabilities module research group conducted focus groups across 12 countries to evaluate the WHOQOL-100 and identify relevant disability specific items (WHOQOL-DIS Group, 2011). Results indicated the WHOQoL was missing several important life factors for individuals with disabilities (Power & Green, 2010). Thus, an item pool of 20 items was created for testing in subsequent pilot study (WHOQOL-DIS Group, 2011).

The research group conducted pilot testing with 1,400 individuals across 15 countries using the 20-item pool (WHOQOL-DIS Group, 2011). This pilot sample consisted of two subsamples, (1) adults with physical disabilities $n=909$ and (2) adults with intellectual disabilities $n=491$ (WHOQOL-DIS Group, 2011). The pilot study concluded with a 13-item disability

module to be used in conjunction with the WHOQOL-100 or WHOQOL-BREF for people with disabilities. The pilot study determined simplification of item wording for the WHOQOL-BREF and WHOQOL-DIS module was needed for intellectual disabilities. Finally, results suggested that the 3-point response scale was more appropriate for participants with intellectual disabilities (Fang et al., 2011).

The WHOQOL-DIS Group concluded with a field trial of the finalized 13-item scale that included 3,772 individuals with disabilities across 14 countries (Fang et al., 2011; Power & Green, 2010). The field trial utilized the simplified wording and 3-point response scale (WHOQOL-DIS-ID) for participants diagnosed with intellectual disabilities and the original 5-point response scale disability module (WHOQOL-DIS) for participants with physical disabilities (WHOQOL-DIS Group, 2011). Confirmatory factor analyses and Rasch modeling concluded with a stable 13-item scale, including one global quality of life question and 12 disability specific items. The scale includes a 3-factor structure, (1) discrimination, (2) autonomy, and (3) inclusion. The 12 disability specific items scores are summed for a total score. Internal consistency was evaluated for the WHOQOL-DIS ($\alpha=.852$) and the WHOQOL-DIS-ID ($\alpha=.808$). The WHOQOL-DIS and WHOQOL-DIS-ID are to be used in addition to either the WHOQOL-100 or WHOQOL-BREF (WHOQOL-DIS group, 2011). The WHOQOL-DIS-ID proved to be more appropriate for study given the findings from Phase 1. This scale was used with permission from the originating author (Powers, 2011). However, the 5-point scale option was used in the WHOQOL-DIS-ID, as cognitive interview participants reported to prefer the 5-point scale and this allowed for greater variability in psychometric analyses.

4.2 ANALYTIC PLAN

The following three research questions guided the statistical analyses: (1) Does each instrument demonstrate internal consistency ($\alpha \geq .8$)? (2) Does each instrument demonstrate test-retest reliability ($ICC > .8$)? (3) Does each instrument establish understanding (agreement $\geq 75\%$)?

Internal consistency reliability estimates will be computed using Cronbach's α (Gliner, Morgan, & Harmon, 2001). Alpha levels greater than .8 were acceptable values. Test-retest reliability was evaluated with interclass correlation coefficients (ICC), equation 2 (Portney & Watkins, 2009).

The following guidelines were utilized to interpret ICC : $<.4$ poor; $<.4-.75$ fair to good; $>.75$ excellent (Fliess, 1986). Understanding scores were evaluated with agreement scores from the Item Analysis Questionnaire (Appendix A). Scores on the Item Analysis Questionnaire were dichotomized into agreement or disagreement. Scores of a 2 or 3 on the scale constituted agreement. Scores of 0 or 1 on the scale constituted disagreement. Percentages of agreement were computed for each scale. If a measure received an agreement rate of $\leq 75\%$, the cognitive interview was used to provide insight on specific confusing items (Lawshe, 1975). Scales were analyzed based on the Item Analysis Questionnaire results, circled items of confusion, written clinician comments, and transcripts of the cognitive interviews. Statistical analyses were run using SPSS, Version 22 (SPSS, Inc).

4.3 RESULTS

4.3.1 Subjects

A total of 22 individuals were involved in this two-phase study. Phase 1 consisted of twenty individuals diagnosed with Autism Spectrum Disorder, Pervasive Developmental Disability, or Asperger's. Phase 2 consisted of 20 subjects as well, with eighteen of the Phase 2 sample the same subjects from Phase 1. Two individuals from Phase 1 were discharged from the training facility between phases. Thus, two additional individuals were recruited and consented. The total n across both phases was 22 subjects.

The mean age of subjects was 20.7 ($SD = 2.98$) with a range of 19-32. The sample consisted of 81.8% male and 18.2% female subjects, with 95.5% of subjects identified as Caucasian and 4.5% identified as Native American. All participants successfully completed high school with a high school diploma. All subjects had a primary diagnosis of Autism Spectrum Disorder, Pervasive Developmental Disability, or Asperger's. Secondary, comorbid, diagnoses included the following: Attention Deficit Hyperactivity Disorder (50%), Generalized Anxiety Disorder (9.1%), Depressive Disorder (9.1%), Obsessive Compulsive Disorder (4.5%), seizures (4.5%), and hearing loss (4.5%). Subjects consisted of students at the Hiram G. Andrews Center (HGAC), a secondary education vocational training center for individuals with disabilities. Students at HGAC are referred from the state vocational rehabilitation program.

Intelligence testing scores (WAIS III, WAIS IV, MAB) were collected for all participants as part of eligibility screening for inclusion in this research study. The mean full scale IQ of subjects was 94.35 ($SD=12.69$) with a range of 80-133. The mean Verbal Comprehension Index IQ scores of subjects was 101.75 ($SD=16.9$) with a range of 83-147. When available ($n=11$),

similarities subtest scores were collected as it is a marker for abstract thinking and it was hypothesized this ability impacts self-reporting outcomes. Similarities subtest scale scores ranged from 7-17, with a mean of 10.5 ($SD=3.17$). Thus, no sample subjects fell below the low average range on measures of either full scale IQ or abstract reasoning.

4.3.2 Outcomes

4.3.2.1 Satisfaction with Life Scale (SWLS)

The SWLS passed the cognitive interviews, as all participants indicated that the questions and wording of the questions were easy to understand (agreement = 100%). Transcription review indicated that participants answered the questions appropriately, without requiring assistance or prompting. Further, participants' answers reflected appropriate completion of each item.

The SWLS demonstrated acceptable internal consistency ($\alpha = .79$) and excellent test-retest reliability ($ICC_2 = .948$). These results suggest that the SWLS is an appropriate life satisfaction measure for this population. See Table 4 below for agreement and reliability statistics.

4.3.2.2 Child and Adolescent Mindfulness Measure (CAMM)

The CAMM also passed the cognitive interviews, as all participants indicated that the questions and wording of the questions were easy to understand (agreement = 100%). Transcription review indicated that participants answered the questions without requiring assistance or prompting. Participants' answers were appropriate and applicable to each item.

The CAMM demonstrated acceptable internal consistency ($\alpha = .831$) and excellent test-retest reliability ($ICC_2 = .956$). These results suggest that the CAMM is an appropriate

mindfulness measure for use with adults diagnosed with ASD. See Table 4 below for agreement and reliability statistics.

4.3.2.3 WHOQOL-BREF and WHOQOL-DIS

Participants had difficulty completing the WHOQOL-BREF and WHOQOL-DIS during the cognitive interview process. These assessments received a 75% agreement rating on the Item Analysis Questionnaire. Specifically, items 3, 4, 21, and 25 required assistance from the interviewer. Further, participants in the assessment only group requested assistance from research assistants on the same items. Overall, item 21 caused the most confusion amongst participants.

Three of the eight cognitive interview participants found the wording of item 3 difficult (“To what extent do you feel that physical pain prevents you from doing what you need to do?”). The phrase “to what extent” was circled by participants as confusing. Four of the eight cognitive interview participants required assistance answering item 4 (“How much do you need any medical treatment to function in your daily life?”). Specifically, participants had difficulty understanding if item 4 included medications. Six of the eight cognitive interview participants requested assistance for item 21 (“How satisfied are you with your sex life?”). Item 21 was difficult to answer for those participants who were not sexually active. Thus, participants could not infer that they should answer rate their satisfaction with being sexually inactive. Participants circled item 25 (“How satisfied are you with your transport?”) as confusing due to the word ‘transport’.

The clinical interviewer also recorded that participant answers and explanation of answers did not always make sense for the item, indicating confusion. This was often prompted for rating understanding of the item. The interviewer also recorded that 5 of the 8 participants

frequently forgot the time reference of the instrument (past two weeks). Items that referred to living place, local activities, and physical environment were difficult for participants. It is likely that this is due to the study sample, as all participants were post-secondary education students living at a vocational training facility. Thus, they often answered these items while reflecting on their home town (months prior).

The WHOQOL-BREF demonstrated variable internal consistency across domains, ranging from $\alpha = .387$ - $.821$ across domains. Item 4 was eliminated from the physical health domain due to qualitative evidence from the cognitive interviews and quantitative internal consistency by item analyses. Internal consistency was improved with the elimination of item 4 from $\alpha = .387$ to $\alpha = .728$. The social relationships domain also did not perform in qualitative or quantitative analyses. Participants reported the most difficulty with item 21 (satisfaction of sex life) during the cognitive interviews. Item 22 caused problematic alpha level, as internal consistency was improved with the elimination of item 22 from $\alpha = .548$ to $\alpha = .649$. There are only three items in the social relationships domain, and two of the items indicated problems in this study sample. The WHOQOL-BREF demonstrated excellent test-retest reliability across all domains, ranging from $ICC_2 = .83$ - $.95$. See Table 4 below for agreement and reliability statistics.

The WHOQOL-DIS also demonstrated variable internal consistency across factor domains, ranging from $\alpha = .352$ - $.881$ across domains. The discrimination domain had the lowest internal consistency ($\alpha = .352$), but it did not improve with the elimination of any items. It should be noted that the discrimination scale has only 3 items. Participants did not report confusion with any of the wording in the WHOQOL-DIS module. However, several participants explained answers that were outside of the two-week time reference. The WHOQOL-DIS demonstrated

excellent test-retest reliability across all factor domains and total score, ranging from $ICC_2 = .76 - .88$. See Table 4 below for agreement and reliability statistics.

4.3.2.4 WHOQOL-BREF-ID (modified 5-point response) and WHOQOL-DIS-ID

The WHOQOL-BREF-ID and WHOQOL-DIS-ID scales were not originally selected for this study as they were developed for individuals with intellectual disabilities and this study excluded for intellectual disability. However, the WHOQOL-BREF-ID and WHOQOL-DIS-ID versions have simplified wording on many of the items that caused confusion during the WHOQOL-BREF and WHOQOL-DIS cognitive interviews (items 3, 4, and 25). The ID versions also have examples provided to aid understanding and item completion.

The WHOQOL-BREF-ID and WHOQOL-DIS-ID utilize a 3-item response scale due to results in a pilot validation study with individuals with ID (Fang et al., 2011). However, this does limit variability in responses. Due to the difficulties with the WHOQOL-BREF and WHOQOL-DIS, it was determined that a second phase of the study should be completed with the WHOQOL-BREF-ID and WHOQOL-DIS-ID using the same methodology. However, cognitive interview participants were asked preference on 3 or 5 item-response scales.

Participants had less difficulty completing the WHOQOL-BREF-ID and WHOQOL-DIS-ID during the cognitive interview process. These assessments received a 100% agreement rating on the Item Analysis Questionnaire. In addition, all 8 participants indicated a preference for a 5-point response scale. Item 21 still required assistance from the interviewer. Many participants still indicated that they could not answer the question because they were not sexually active. The interviewer had to prompt participants to consider their satisfaction with not having an active sex life. The ID version corrected confusion on items 3, 4, and 25 due to changes in wording and examples provided with each question. Participants still made errors related to the two-week time

reference point on items related to living place, local activities, and physical environment. All participants reported to prefer the 5 item-response scale in comparison to the 3.

Similar to the WHOQOL-BREF, the WHOQOL-BREF-ID demonstrated variable internal consistency across domains, ranging from $\alpha = .464$ - $.821$ across domains. Only the psychological domain demonstrated acceptable internal consistency ($\alpha = .821$). Item 4 performed similarly in the ID version as the original WHOQOL-BREF. Item 4 was eliminated from the physical health domain due to qualitative evidence from the cognitive interviews and quantitative internal consistency by item analyses. Internal consistency was improved with the elimination of item 4 from $\alpha = .464$ to $\alpha = .704$. The social relationships domain still did not perform in qualitative or quantitative analyses. Participants still reported difficulty with item 21 (satisfaction of sex life) during the cognitive interviews. Problems with item 22 were consistent with the phase 1 version, as internal consistency was improved with the elimination of item 22 from $\alpha = .558$ to $\alpha = .767$. Alpha levels for the environmental domain were lower than acceptable standards ($\alpha = .696$). The WHOQOL-BREF-ID demonstrated excellent test-retest reliability across all domains, ranging from $ICC_2 = .87$ - $.93$. See Table 4 below for agreement and reliability statistics.

The WHOQOL-DIS-ID also demonstrated variable internal consistency across factor domains, ranging from $\alpha = .412$ - $.924$ across domains. The discrimination domain had the lowest internal consistency ($\alpha = .412$), but improved with the elimination of item 30 ($\alpha = .612$). The autonomy domain demonstrated an alpha of $.689$ but improved with the elimination of item 33 ($\alpha = .707$). Although internal consistency improved with the elimination of items, qualitative data from the cognitive interviews did not indicate confusion or difficulty with items 30 and 33. Thus,

they were not eliminated in final analyses. It should be noted that both the discrimination and autonomy factors have only 3 items.

Participants did not report confusion with any of the wording in the WHOQOL-DIS-ID module. However, several participants explained answers that were outside of the two-week time reference. The WHOQOL-DIS-ID demonstrated excellent test-retest reliability across all factor domains and total score, ranging from $ICC_2 = .79 - .94$. See Table 4 below for agreement and reliability statistics.

Table 4: Reliability and agreement statistics for mindfulness and QOL instruments.

Measure	Mean (<i>SD</i>)	Internal Consistency (α)	Test-retest (<i>ICC</i> , 2,1)	Item Understanding (% <i>Agreement</i>)
SWLS	27.8 (4.3)	.789	.948	100%
CAMM	22.05 (6.96)	.831	.956	100%
WHOQOL-BREF				
Physical Health Domain	16.25 (1.56)	.387	.89	
Without Q4		.728	.90	
Psychological Domain	15.7 (2.59)	.851	.94	
Social Relationships Domain	15.18 (2.86)	.548	.907	
Environmental Domain	15.78 (2.02)	.791	.83	
Total	62.78 (8.32)	.911	.95	75%
WHOQOL-DIS				
Discrimination Domain	11.6 (2.01)	.352	.839	
Autonomy Domain	12.3 (2.25)	.836	.768	
Inclusion Domain	22.65 (4.59)	.853	.870	
Total	46.5 (7.7)	.881	.882	75%
WHOQOL-BREF-ID (5-point mod.)				
Physical Health Domain	16.03 (2.06)	.464	.877	
Without Q4		.704	.919	
Psychological Domain	16.2 (2.98)	.821	.93	
Social Relationships Domain	16.15 (3.09)	.558	.879	
Environmental Domain	15.72 (2.2)	.696	.869	
Total	63.73 (8.67)	.901	.932	100%
WHOQOL-DIS-ID				
Discrimination Domain	11.95 (2.18)	.412	.854	
Autonomy Domain	12.75 (2.14)	.689	.786	
Inclusion Domain	23.3 (5.14)	.924	.942	
Total	48 (8.3)	.911	.932	100%

4.4 LIMITATIONS

This study had some methodological limitations, including sample size, study sample, and the identification of targeted assessments. The sample consisted of a convenience sample in a specific rehabilitation environment. Participants were recruited from a state rehabilitation vocational facility, the Hiram G. Andrews Center (HGAC). All students at this training center are individuals with disabilities receiving post-secondary vocational training. Most students at this facility are transition-age individuals, which was reflected in this study sample (ages ranging 18-32). At this facility, diagnoses are made and tracked cumulatively from medical, psychiatric, and high school IEP records for eligibility for the vocational rehabilitation program. Thus, the disability diagnoses of this study population are not those of a clinical research study. The unique residential environment likely impacted this research study in a few ways. First, this environment is inclusive for individuals with disabilities and excludes individuals without disabilities. Thus, this might have impacted ratings on QOL measures. Further, participants of this study indicated item confusion related to items with location descriptors, such as living place, local activities, and physical environment. This is likely a function of the fact that participants were living at this facility for temporary schooling. Thus, it might have caused the confusing with these specific items. It is possible that adults with ASD living in the community would find those items to be easy to understand.

The scope and process for selection of the target self-report assessments is another potential limitation of this study. Researchers used ASD experts to choose the mindfulness

measure (CAMM) examined in this study. Experts chose the CAMM due to its simplified wording and low number of item describing internal states. The CAMM differs from other commonly used mindfulness measures (MAAS and KIMS) since it does not include items related to describing internal experiences (Greco et al., 2015). This scale was designed this way due to the developmental cognitive capacity of adolescents. However, individuals with ASD experience similar cognitive delays in executive functioning as adolescents. Further, individuals with ASD have difficulty describing internal thoughts and feelings (Lombardo et al., 2007; Rieffe et al., 2006). Thus, study experts concluded this was the most appropriate mindfulness measure. Future research may want to explore a more inclusive scope of adult mindfulness measures for this population, as mindfulness interventions are becoming increasingly popular for this population.

4.5 DISCUSSION

All measures demonstrated excellent test-retest reliability, suggesting that participants can reliably and consistently report on QOL and mindfulness constructs. Results suggest that the SWLS and CAMM are appropriate measures for adults diagnosed with ASD, as both demonstrated acceptable internal consistency, excellent test-retest reliability, and item understanding. Participants appropriately explained answers on both scales during cognitive interviews, suggesting that answers were accurately completed. The sample consisted of a wide range of intellectual capabilities (FS IQ range 80-133; Verbal IQ range 83-147), suggesting that these results are not limited to those with high verbal intellectual functioning.

Results do not support the use of the WHOQOL-BREF or WHOQOL-DIS with an adult ASD population, as participants indicated confusion and challenges during cognitive interviews. Further, the WHOQOL-BREF and WHOQOL-DIS did not meet standards for internal consistency or item understanding. Participants in the assessment only group also requested assistance for confusion related to item wording on the same items, further supporting the low agreement rate on the Item Analysis Questionnaire.

Alternative ID versions of the WHOQOL-BREF and WHOQOL-DIS were evaluated in attempt to identify an appropriate QOL measure for this population. The WHOQOL-BREF-ID and WHOQOL-DIS-ID did demonstrate improved item understanding and less problems in the cognitive interviews (agreement = 100%). However, internal consistency was still problematic across the subdomains. Specifically, the social relationships domain of the WHOQOL-BREF and WHOQOL-BREF-ID did not meet internal consistency standards. Participants reported problems with this domain in all cognitive interviews as well. These results suggest that either version the WHOQOL-BREF and WHOQOL-DIS may be inappropriate for this population. However, the WHOQOL-BREF-ID and WHOQOL-DIS-ID are preferred to the original versions given the item understanding results. Additional quantitative analyses are recommended to formally exploring the choice of 3 and 5-point scaled responses. Results from the cognitive interviews suggest that a 5-point scaled response is preferred but this was not confirmed with psychometric analyses.

Intelligence did not appear to be a significant factor in the understanding of outcome measure items in persons with ASD. The challenges reported on the cognitive interviews were consistent across levels of intellectual functioning, as item confusion was reported by individuals with Verbal IQ scores higher than 130 (superior) and lower than 80 (low average). Item 21

(satisfaction with sex life) consistently caused the most problems for participants in either version or study group (assessment only and cognitive interview). Participants were not able to rate their satisfaction with an area that they perceived did not apply to them. Thus, they could not make the inference to report their satisfaction with their sexual life status when not sexually active. Further, participants had difficulty applying items to their current place of residence. Many participants answered items that included descriptors of home or place of residence (“local activities”) incorrectly. They answered these items for their hometown when they currently lived at a vocational training facility. These errors consistently violated the two-week time reference of the scale. Thus, challenges related to item understanding and scale completion appear to be related to limitations in flexible thinking and concrete interpretations of item wording rather than intellectual ability.

Items and domains related to social relationships did not perform similarly to the validation samples (WHOQOL-DIS Group, 2011). It is likely that this is specific to this population, as the hallmark limitation of ASD is social functioning. Individuals with ASD have difficulty forming relationships, understanding other points of views, and maintaining traditional ‘friendships’ (McCrimmon et al., 2014). This likely caused the social items such as ‘Are you satisfied with the support you get from your friends?’ (item 22) to not perform well in this sample. It is possible that this population requires QOL measures designed specifically for their unique needs and social challenges.

In conclusion, this study suggests that the CAMM and SWLS are appropriate measures for this population. It should be noted that this study consisted of a small sample (n=22) in a specific environment of post-secondary vocational training. The sample also consisted of individuals diagnosed with ASD with exclusion of Intellectual Disabilities (ID). Thus,

conclusions do not apply to individuals with IQ scores lower than this study sample. Further research is warranted prior to making conclusions related to the use of the WHOQOL-BREF (-ID) and WHOQOL-DIS(-ID) with this population. These findings indicate that it may be beneficial for future research to explore other QOL measures or to specifically design QOL measures for ASD to capture satisfaction with social relationships. It is possible that limitations in flexible thinking and concrete interpretations of questions impacted the understanding of the WHOQOL measures. Future studies of self-report assessments in this population may want to examine more specifically how limitations in flexible thinking and abstraction impact subject understanding of complex and abstract outcome constructs.

5.0 RESEARCH PROJECT 2: MBSR FEASIBILITY TRIAL FOR ADULTS WITH ASD

This project aimed to establish feasibility of utilizing Mindfulness-Based Stress Reduction for adults with Autism Spectrum Disorder. The primary aim of this study was to establish feasibility and acceptability of MBSR for use with adults diagnosed with ASD. The secondary aim of this study was to maintain the fidelity and integrity of MBSR while utilizing with a new population. The tertiary aim was to calculate effect size estimates on targeted self-report outcome measures.

5.1 METHODOLOGY

5.1.1 Design and Overall Study Approach

This project utilized a quasi-experimental design to explore the feasibility of a MBSR group intervention for adults diagnosed with ASD. The study was approved by the University of Pittsburgh Institutional Review Board (PRO1605633). The study involved participation in one MBSR group, and participants completed assessments at pre-treatment, mid-treatment, and post-treatment assessment. Participants were asked to attend the 9-week intervention, including a 1 hour orientation, 8 weekly 2.5 hour sessions, and a full day silent meditation retreat. Participants were compensated for each study visit, for a total of \$150.

5.1.2 Participants and Eligibility

Sample size estimation was based on the feasibility of subject recruitment and having sufficient statistical power (80%) when testing hypotheses. The minimum detectable effect size using a within factors repeated measure F-test for one group, with significance of .05 and assuming a moderate correlation ($r=.50$) among three repeated measures, is $d=.8$. Gotink et al conducted a meta-analysis of all RCTs that utilized the standard MBSR and MBCT interventions. They found effect sizes of improved quality of life ($d=.38$) and anxiety ($d=.51$) following intervention that were small to moderate in size (Gotink et al., 2015). Spek et al. conducted an RCT that examined the efficacy of MBCT with 41 adults diagnosed with ASD (2013). Their study found large effects of reduced anxiety ($d=.76$) and increased positive affect ($d=.79$).

This study aimed to recruit 10-15 adults diagnosed with ASD for participation in a group MBSR intervention. Participants were recruited from local multi-disciplinary collaborators, including the UPMC Center for Excellence in Autism Research, UPMC Merck Adult Outpatient Clinic, University of Pittsburgh Disability Services, Autism Connection, and a research registry. Participants were also recruited from local support groups.

Inclusion Criteria:

- Participants were required to have a documented diagnosis of Autism Spectrum Disorder, Pervasive Developmental Disorder, or Asperger's to participate.
- Participants were required to travel to the University of Pittsburgh and the UPMC Center for Integrative Medicine for study visits.
- Participants were 18 years of age or older.

Exclusion Criteria:

- Intellectual Disability diagnosis or full scale IQ score <70 (WASI)
- Verbal intelligence scores <75 (WASI-V)
- Similarities Score ≤ 5 (WASI-V)
- Psychiatric hospitalization or major depressive episode less than 18 months prior to enrollment (determined by history).
- Previous attendance and completion of a Mindfulness-Based Stress Reduction course.
- Unwilling to fully participate or disinterested in the research study.
- Behavioral evidence of the inability to participate in a group intervention (i.e. frequent interruptions, inability to respond to direction from a group leader, verbally reporting marked difficulty with group settings).

5.1.3 Procedure

Participants were pre-screened by telephone. Participants then completed eligibility screening and intelligence testing (WASI) in person at the University of Pittsburgh. Following consenting to participate in the study, eligibility criteria was confirmed through medical records (formal diagnoses and psychiatric hospitalizations). Pending confirmation of eligibility criteria, participants were enrolled in the study. Twelve adults diagnosed with ASD participated in the group MBSR intervention.

Upon enrollment, participants were scheduled for a 1.5-hour group orientation and pre-treatment testing. The orientation consisted of a review of the intervention, discussion of the course and expectations of the course, and a group meditation practice. Participants had a private

5-10 minute meeting with the MBSR teacher. Participants were asked to confirm their desire to remain in the research study following the information provided at orientation. The intervention consisted of 9 sessions, 8 2.5-hour weekly group sessions, and a 7.5-hour meditation retreat between weeks 6 and 7.

Participants completed an assessment battery at three time points. Assessments occurred at baseline, mid-intervention, and post intervention. Participants completed these assessments with a research assistant, and participants had the option to complete these on paper or on the computer via Qualtrics. Participants also completed an exit interview with the designated research assistant (See appendix B). Exit interviews were audio recorded and transcribed. The research assistant had two years of clinical experience working with adults diagnosed with ASD. The same research assistant was used for the entire study. Participants were compensated at the mid-treatment and post-treatment assessment appointments.

5.1.4 Intervention

The intervention for this study consisted of the Mindfulness-Based Stress Reduction curriculum published by the University of Massachusetts Center for Mindfulness in Medicine, Health Care, and Society. The MBSR teacher followed the standardized curriculum as provided by UMass. This included 8 weekly 2.5-hour sessions and a full day (7.5 hours) silent meditation retreat after week 6. An orientation session and individual interview occurred before the 8-week group course. Homework assignments include 45 minutes of mindfulness practice a day and 5-15 minutes of informal practice for 6 days a week. In total, the intervention consisted of 29 hours of class time and 42-48 hours of homework. Curriculum themes, homework exercises, and meditations were all consistent with the standardized MBSR curriculum. However, MBSR is

designed for heterogeneous groups. This study utilized a homogeneous study sample of adults diagnosed with Autism Spectrum Disorder for internal validity purposes.

The MBSR teacher for this study had the necessary clinical training for both MBSR and the adult ASD population. The teacher has maintained a formal meditation practice for over 8 years. The teacher completed teacher training through the University of Massachusetts Oasis Institute for Mindfulness-based Professional Education and is recognized by the Oasis Institute as a Qualified MBSR instructor. The teacher had assisted senior teachers in 3 MBSR courses for the general population, with increasing level of responsibility for guiding practices. The teacher had over five years of rehabilitation counseling experience working with adults diagnosed with ASD. Specifically, the teacher has over four years of using mindfulness with adults with ASD (Beck, 2014; PRO16100106). The teacher developed a 15-week mindfulness skills group for adults with cognitive disabilities as part of a larger cognitive rehabilitation program and implemented 11 groups over the course of 4 years (Beck, 2014; PRO16100106).

The study did not modify or adapt the MBSR curriculum for use with the ASD population. The aim of the study was to evaluate feasibility of the standardized curriculum for use with this population. The MBSR teacher tracked all activity choices and need for adaptations or modifications for use with this population. The MBSR teacher also evaluated participation and understanding of material for each participant at the end of every group session. The MBSR teacher reviewed the group weekly with the previously mentioned senior teacher to discuss any challenges, necessary adjustments to teaching, or activity choices within the curriculum.

Intervention fidelity and teacher competence was rated by an expert reviewer using the Mindfulness-Based Intervention – Teacher Assessment Criteria (MBI-TAC). All MBSR sessions were audio recorded and transcribed for evaluation of teaching competencies. The expert

reviewer was a senior MBSR teacher certified by the University of Massachusetts Center for Mindfulness who has 13 years of experience teaching MBSR with a variety of populations. The reviewer also has experience adapting MBSR for individual sessions and populations requiring curriculum adaptations. The reviewer was trained on the use of the MBI-TAC by the developers Rebecca Crane, PhD, and Willem Kuyken, PhD. The expert reviewer evaluated 25% (2 classes) of the study sessions.

5.1.5 Measures

5.1.5.1 Client Satisfaction Questionnaire (CSQ-8)

Feasibility and acceptability was measured in part by evaluating participants' satisfaction with the intervention. The Client Satisfaction Questionnaire (CSQ-8) is a self-report survey evaluating client satisfaction with services received (Larsen, Attkisson, Hargreaves, & Nguyen, 1979). The CSQ-8 is designed to be administered at posttreatment after services are completed. The scale includes 8 items with 4-point response scales. Scores are summed for a total score of satisfaction, ranging 8-32, with higher scores indicate higher satisfaction. The CSQ-8 has been established to have strong internal consistency ($\alpha = .86$ ranging to $\alpha = .94$) (Larsen et al., 1979; Lunnen & Ogles, 1998). Research has also indicated that lower scores on the CSQ-8 correlate with higher attrition rates (Lunnen & Ogles, 1998).

The stems of the CSQ-8 were modified from “service received” to “the mindfulness program” for this study. The CSQ-8 was administered at the post-treatment assessment appointment.

5.1.5.2 Pittsburgh Rehabilitation and Participation Rating Scale (PRPS)

Intervention acceptability was measured in part by the PRPS scale to determine the level of interest and engagement in the intervention. The PRPS is a clinician-rated measure that evaluate client participation in acute inpatient rehabilitation (Lenze, Munin, Quear, Dew, Rogers, Begley, & Reynolds, 2006). Clinicians rate client participation on a 6-point Likert scale, including (1) none, (2) poor, (3) fair, (4) good, (5) very good, (6) excellent. The scale was developed and validated with physical therapists and occupational therapists working in acute inpatient hospital settings. Adequate inter-rater reliability was established with both physical therapists ($ICC = .96$) and occupational therapists ($ICC = .91$). Although developed for inpatient rehabilitation, this scale has been used with cognitive disability populations. Thus, this scale was still determined to be valuable for this study.

This scale was modified slightly for this study, as this was not an inpatient acute rehabilitation setting for physical or occupational therapy. Operational definitions were added for each of the 6-point response options that reflected the group content while acknowledging social skill limitations for an adult ASD population. A rating of 1, no participation, was operationalized as complete lack of engagement or connection with the group process, talking through meditations, and continuous inappropriate disruptions. A rating of 2, poor engagement, was operationalized as frequent inappropriate disruptions and interruption of others unrelated to the discussion topic or consistent focus on repetitive interest unrelated to discussion topic. A rating of 3, fair engagement, was operationalized as participated in most activities but not all, required much encouragement to participate in activities, or required much instruction to participate in activities. A rating of 4, good engagement, was operationalized as participated in all activities but with a passive attitude or minimal unsolicited participation in group discussion or occasional

perseveration on repetitive interest unrelated to discussion topic. A rating of 5, very good engagement, was operationalized as participation in all activities, active engagement, but required minor prompting from leader to participate in group discussion or over-participation or monopolizing group discussion. A rating of 6, excellent engagement, was operationalized as full participation with maximal effort, maximum interest, and full participation in group discussions or activities.

The MBSR teacher completed the PRPS for each study participant immediately following every MBSR group session.

5.1.5.3 Understanding of Material Scale (UOMS)

Intervention acceptability was measured in part by the UOMS scale to determine that MBSR is within the cognitive capacity of this population, especially given the level of abstraction associated with mindfulness. The Understanding of Material Scale is a clinician-rated measure to rate client understanding of intervention. Clinicians rate client participation on a 3-point response scale, including (1) Minimal understanding, (2) Some understanding, and (3) Good understanding. Response scale options are defined based on client responses to therapist questions, discussion, relevance of client's personal examples, and number of prompts from therapist.

The MBSR teacher completed the UOMS for each study participant immediately following every MBSR group session.

5.1.5.4 Mindfulness-Based Intervention Teacher Assessment Criteria (MBI-TAC)

The MBI-TAC served as the curriculum fidelity and teacher integrity assessment for this feasibility trial. The MBI-TAC is a teacher integrity and fidelity assessment tool designed for

group mindfulness-based interventions, specifically MBSR and MBCT (Crane, Eames, Kuyken, Hastings, Williams, Bartley, Evans, Silverton, Soulsby, Surawy, 2013). The MBI-TAC was developed by MBSR and MBCT teaching experts and ‘teacher trainers’ that train new MBSR and MBCT teachers (Crane et al., 2013). The MBI-TAC includes six competence domains, including the following: (1) Coverage, pacing, and organization of session; (2) Relational skills; (3) Embodiment of mindfulness; (4) Guiding mindfulness practices (5) Conveying course themes through interactive inquiry and didactic teaching; (6) Holding the group learning environment (Crane et al., 2013). Each domain is rated on level of competence, ranging from incompetent (1), beginner (2), advanced beginner (3), competent (4), proficient (5), and advanced (6). Domain competence scores are then averaged for an overall competence rating. Internal consistency by of the tool was measured with Cronbach’s alpha. Results indicated adequate internal consistency (α range = .88 - .92) and inter-rater reliability overall ($ICC = .81$) (Crane et al., 2013). Raters were experienced teachers trained in the use of the MBI-TAC. See Table 6 for reliability statistics reported in MBI-TAC validation study (Crane et al., 2013)

The MBI-TAC was completed for 25% of the MBSR group sessions. The expert rater randomly chose 2 sessions to review for fidelity and integrity.

5.1.5.5 Satisfaction with Life Scale (SWLS)

MBSR has been shown to significantly improve QOL and life satisfaction. Thus, the SWLS was used as a global measure of satisfaction with quality of life and well-being. The SWLS has five items asking participants to self-report their holistic well-being. Research Study 1 of this project evaluated the SWLS with a sample of adults with ASD. Test-retest reliability ($ICC_2=.948$) and internal consistency ($\alpha=.789$) were established.

The SWLS was administered to all participants at pre-treatment, mid-treatment, and post-treatment.

5.1.5.6 WHOQOL-BREF-ID (modified 5-point response scale)

The WHOQOL-BREF consists of 26 items and four domains, physical health, psychological, social relationships, and environment. The WHOQOL-DIS work group created a simplified version of the WHOQOL-BREF for individuals with intellectual disabilities, WHOQOL-BREF-ID (The WHOQOL-DIS Group, 2011). This version contains the same root items as the WHOQOL-BREF but with simpler phrasing. The WHOQOL-BREF-ID was used to evaluate changes in QOL throughout the MBSR intervention.

Research Study 1 of this project modified the WHOQOL-BREF-ID to use a 5-point response scale based from cognitive interview suggestions from adults with ASD. Test-retest reliability ($ICC_2=.932$) and internal consistency ($\alpha=.901$) were evaluated. This scale was used with permission from the originating author (Powers, 2011).

The WHOQOL-BREF ID (modified 5-point response scale) was administered to all participants at pre-treatment, mid-treatment, and post-treatment.

5.1.5.7 WHOQOL-DIS-ID (modified 5-point response scale)

The WHOQOL-DIS is a 13-item scale, including one global quality of life question and 12 disability specific items. The scale includes a 3-factor structure, (1) discrimination, (2) autonomy, and (3) inclusion. The 12 disability specific items scores are summed for a total score. The WHOQOL-DIS-ID is to be used in addition to the WHOQOL-BREF (WHOQOL-DIS group, 2011). This scale was used with permission from the originating author (Powers, 2011).

The WHOQOL-DIS-ID was used to evaluate changes in disability specific aspects of QOL throughout the intervention.

Research Study 1 of this project modified the WHOQOL-DIS-ID to use a 5-point response scale based on the cognitive interview suggestions from adults with ASD. Test-retest reliability ($ICC_2=.932$) and internal consistency ($\alpha=.911$) were evaluated. This scale was used with permission from the originating author (Powers, 2011).

The WHOQOL-DIS-ID (modified 5-point response scale) was administered to all participants at pre-treatment, mid-treatment, and post-treatment.

5.1.5.8 Child and Adolescent Mindfulness Measure (CAMM)

The CAMM was used to evaluate changes in mindfulness throughout the MBSR intervention. The CAMM is a ten-item single factor scale to measure mindfulness (Greco, Baer, & Smith, 2015). Items on the CAMM are summed for a total score, ranging from 0-40. Research Study 1 of this project evaluated the CAMM with a sample of adults with ASD. Test-retest reliability ($ICC_2=.956$) and internal consistency ($\alpha=.831$) were evaluated.

The CAMM was administered to all participants at pre-treatment, mid-treatment, and post-treatment.

5.1.5.9 Neuro-QOL Anxiety Form

MBSR has been shown to significantly improve anxiety across multiple populations. The Neuro-QOL Anxiety Short Form is a quality of life instrument evaluating the impact of anxiety for individuals with neurological conditions. Thus, this measure was chosen to evaluate symptom changes in anxiety in this trial. The Neuro-QOL Anxiety Short Form includes 8 items related to anxiety symptoms (Gershon, Lai, Bode, Choi, Moy, Bleck, Miller, Peterman, & Cella, 2012).

The scale has demonstrated internal consistency with an alpha coefficient of .96. Analyses also confirmed that it only contained one factor. The measure was validated with a clinical population of neurological conditions including: stroke, multiple sclerosis, Parkinson's disease, epilepsy, and ALS. (Gershon et al., 2012).

The Neuro-QOL Anxiety Form was administered to all participants at pre-treatment, mid-treatment, and post-treatment.

5.1.5.10 HEAL Positive Outlook Scale-Short Form

The Healing Encounters and Attitudes Lists (HEAL) Positive Outlook Scale is a unidimensional 27 item scale (Greco et al., 2016) designed to be administered as a computerized adaptive test (CAT) or a short static form. Theta scores derived from the six-item short form has $> .93$ correlation with Theta scores derived from the full Positive Outlook item bank. Items include questions about positivity, life satisfaction, confidence, hope, future, and coping. High internal consistency for the short form was established with alpha of .96. Construct validity was established via high ($r=-.71$) inverse association between HEAL Positive Outlook and PROMIS Depression. The measure was validated with individuals receiving conventional ($n=130$) or integrative medicine treatment ($n=127$) (Greco et al., 2016).

MBSR has consistently shown to improve overall QOL and life satisfaction. A similar construct is positive outlook on life. Thus, the HEAL Positive Outlook Scale was chosen as an outcome measure for this study. The HEAL Positive Outlook Scale-Short Form was administered to all participants at pre-treatment, mid-treatment, and post-treatment.

5.2 ANALYTIC PLAN

5.2.1 Research Study Aim 1: Feasibility and Acceptability

The primary aim of this research study was to assess the feasibility and acceptability of utilizing MBSR in the adult ASD population. This was examined with recruitment statistics, retention rates, participant satisfaction, understanding of the material, and participation scores. The following research questions guided the statistical analyses: (1) Will 80% of the participants complete 5 of 8 weekly MBSR sessions? (2) Will 80% of enrolled participants receive understanding scores (2 or higher) for 85% of the sessions? Descriptive statistics (means, standard deviations), frequency counts, and percentages were calculated for the retention rates (# of sessions completed). Benchmarks were utilized to interpret frequency calculations, including: attending 5 of 8 sessions. Benchmarks were chosen based on previous clinical experience and consultation with expert MBSR teachers. Scores on the Understanding of Material Scale (UOMS) were dichotomized into understanding or lack of understanding. Scores of a 2 or 3 on the scale constituted understanding. Scores of 1 on the scale constituted lack of understanding. Percentages of understanding were computed for every session.

Additional descriptive measures of feasibility were evaluated with descriptive statistics and frequency counts. The Pittsburgh Rehabilitation Participation Scale (PRPS) was analyzed for participant engagement in two ways. First, descriptive statistics were calculated across all sessions (means, standard deviations). Next, scores on the PRPS were dichotomized into engagement and lack of engagement. Scores of 4, 5, or 6 indicated engagement. Scores of 1, 2, or 3 indicated lack of engagement. Engagement scores were computed for every session. Statistical analyses were exploratory and descriptive.

Additional descriptive measures of acceptability were evaluated with descriptive statistics (means, standard deviations) on the Client Satisfaction Questionnaire (CSQ-8). Scores on the CSQ-8 are sum scores and were considered as continuous variables. Descriptive (means, standard deviations) statistics were calculated, and higher scores (maximum 32) were indicative of higher satisfaction.

Statistical analyses were computed using SPSS, Version 22 (SPSS, Inc.).

5.2.2 Research Study Aim 2: MBSR Fidelity and Integrity

The secondary aim of this research study was to evaluate the fidelity and teacher competency to the MBSR curriculum and teacher training. The following research question guided these statistical analyses: Did the teacher demonstrate overall teaching competency by the MBI-TAC standards? Competency scores were evaluated for 2 sessions and included all 6 domains of MBI-TAC competency scale. Scores were evaluated per session, per competency domain, and overall. Scores of 4 (competent) or higher were interpreted as MBSR fidelity and teacher competency.

5.2.3 Research Study Aim 3: Exploratory Effect Sizes on Target Outcomes

The tertiary aim of this research study was to calculate exploratory effect sizes on the selected outcomes to power future pilot studies. The following research questions guided statistical analyses: (1) Is there a significant difference on QOL scores averaged across time points? (2) Is there a significant difference on mindfulness scores averaged across time points? (3) Is there a significant difference on anxiety scores averaged across time points? (4) Is there a significant difference on positive outlook scores averaged across time points? The dependent variables were

scores from the SWLS, WHOQOL-BREF-ID, WHOQOL-DIS-ID, CAMM, Neuro-QOL Anxiety, and Heal Positive Outlook (continuous, sum scores). There was one independent variable. The within-subjects independent variable was time with 3 levels (baseline, mid, and post). Six one-way within subjects analysis of variance were conducted to evaluate targeted outcomes (Portney & Watkins, 2009, p.451).

Parametric assumptions of normality were evaluated with descriptive statistics and the distribution of each cell with the Shapiro-Wilk W test of normality ($p > .05$ = normality). Histograms, boxplots, and qq plots were evaluated for the presence of major outliers. Homogeneity of variance was examined with Levene's test of homogeneity ($p > .05$ = homogeneity) (Portney & Watkins, 2009). Sphericity was examined by Mauchly's W test of Sphericity ($p > .05$ = sphericity met). The Greenhouse-Geiser adjusted F statistic was used when sphericity was not met. Statistical analyses were computed using SPSS, Version 22 (SPSS, Inc). Power analyses were computed using GPower (Faul, Erdfelder, Lang, & Buchner, 2007). Post-hoc power calculations were based on two-tailed hypotheses, the calculated *partial* η^2 , significance level of .05, power of .8, nonsphericity correction of 1, 1 group, and 3 repeated measurements.

Six one-way within subjects ANOVA (Repeated Measures ANOVA) were conducted to determine if there was a significant change over time. ANOVA results were interpreted using the F statistic (or Greenhouse-Geiser correction) at $p < .05$ significance level. Given a significant interaction effect of time, post hoc simple comparison Bonferroni analyses were calculated on time to determine the level (time) of the significant change ($p < .05$). Effect sizes were evaluated with a partial eta squared statistic for all one-way ANOVA analyses, (Levine & Hullett, 2002). Partial eta squared effect size values were interpreted as the following: small *partial* η^2 = (.01,

.059); medium *partial* $\eta^2 = (.06, .139)$; large *partial* $\eta^2 \geq .14$ (Levine & Hullett, 2002). Effect sizes (Cohen's *d*) were also calculated between time points (pre-mid, mid-post, & pre-post). Cohen's *d* effect size values were interpreted as the following: small $d = (.2, .49)$; medium $d = (.5, .79)$; large $d \geq .8$.

5.3 RESULTS

5.3.1 Sample

This study sample consisted of 12 individuals diagnosed with Autism Spectrum Disorder, Pervasive Developmental Disability, or Asperger's. Diagnoses were confirmed with medical records or ADOS scores. Comorbid diagnoses included the following: Generalized Anxiety Disorder (25%), Depressive Disorder (25%), Attention Deficit Hyperactivity Disorder (16.7%), Post-Traumatic Stress Disorder (8.3%), eating disorders (8.3%), and other psychiatric disorders (8.3%). The mean age of subjects was 37.58 ($SD = 14.04$) with a range of 22-63. The sample consisted of 75% male and 26% female subjects, with 83.3% of subjects identified as Caucasian, 8.3% identified as African American, and 8.3% identified as Asian. Highest level of education completed included some high school (8.3%), high school diploma (8.3%), some college or technical school (33.3%), bachelor's degree (33.3%), and advanced degree (16.7%). One participant reported to be married and two participants (16.3%) reported to have children.

Intelligence testing scores (WASI-II) were collected as part of eligibility screening for inclusion in this research study. The mean full scale IQ of subjects was 102.17 ($SD = 15.3$) with a

range of 76-127. The mean Verbal Comprehension Index (VCI) scores of subjects was 101.9 ($SD=15.5$) with a range of 76-121. The mean Perceptual Reasoning Index (PRI) scores of subjects was 101.4 ($SD=13.5$) with a range of 77-127.

Much of the sample (75%) reported to receive mental health treatment with varying frequency, including: weekly (33.3%), twice monthly (25%), and once monthly (8.3%). However, only 25% of the sample reported to receive treatment for their ASD. Specifically, participants received ASD treatment in the form of psychotherapy (16.6%) and vocational support (8.3%). Forty-one percent of the sample reported to take medication daily. There were no participants that reported to meditate regularly at baseline. Two participants (16.6%) reported to regularly practice yoga.

5.3.2 Research Question 1: Feasibility and Acceptability

5.3.2.1 Recruitment & Retention Rates

Recruitment occurred over the course of 4 months. Recruitment procedures through ASD research and clinical providers at the University of Pittsburgh including, the UPMC Center for Excellence in Autism Research, University of Pittsburgh research registry (Pitt + Me), the Merck program, distributing flyers to local autism groups and/or services, and attending local autism support groups. Twenty-five individuals expressed interest in the research study. Twenty individuals completed pre-screening procedures and two were excluded for diagnostic inclusion criteria. Eighteen individuals were scheduled for behavioral and IQ screening. Four individuals were excluded due to the following: FSIQ scores lower than 70 ($n=1$), behavioral evidence of the inability to participate in a group ($n=2$), and missed screening appointment without rescheduling ($n=2$). Fourteen individuals consented to participate in the research study. However, two

individuals did not begin study procedures due to scheduling conflicts with the groups. Figure 4 below depicts the recruitment and retention rates.

There were several recruitment challenges specific to this population. Many of the individual who expressed interest in the study were not able to travel independently to appointments. This required support from family members or caregivers. Many participants chose to involve family members or caregivers in the consenting appointments. As a result, research staff often scheduled with family members or caregivers rather than the participant. In addition, many interested individuals expressed discomfort with using the telephone. Thus, research staff often waived the pre-screen via telephone and scheduled an in-person screening appointment for the pre-screen, behavioral screen, and IQ testing.

The study sample consisted of twelve individuals who began research procedures. All participants completed the MBSR intervention (5 of 8 weekly sessions) and post assessments. Overall, eight participants (66.7%) of the sample completed all study appointments. Seven participants completed all intervention session (8 weekly and full day retreat) at the scheduled times. Two participants (16.6%) missed two weekly sessions but attended two 2-hour make-up sessions prior to the next weekly session. Three participants (25%) missed one weekly session but did not make up the session. One participant (8.3%) missed three weekly sessions and did not make up the sessions. Eleven individuals attended the all-day 7.5-hour silent meditation retreat.

Based upon predetermined criteria, the research study had excellent retention rates and attendance. Research question 1 of this study was met (Will 80% of the participants complete 5 of 8 weekly MBSR sessions?), as 100% of study participants completed 5 of 8 weekly MBSR sessions.

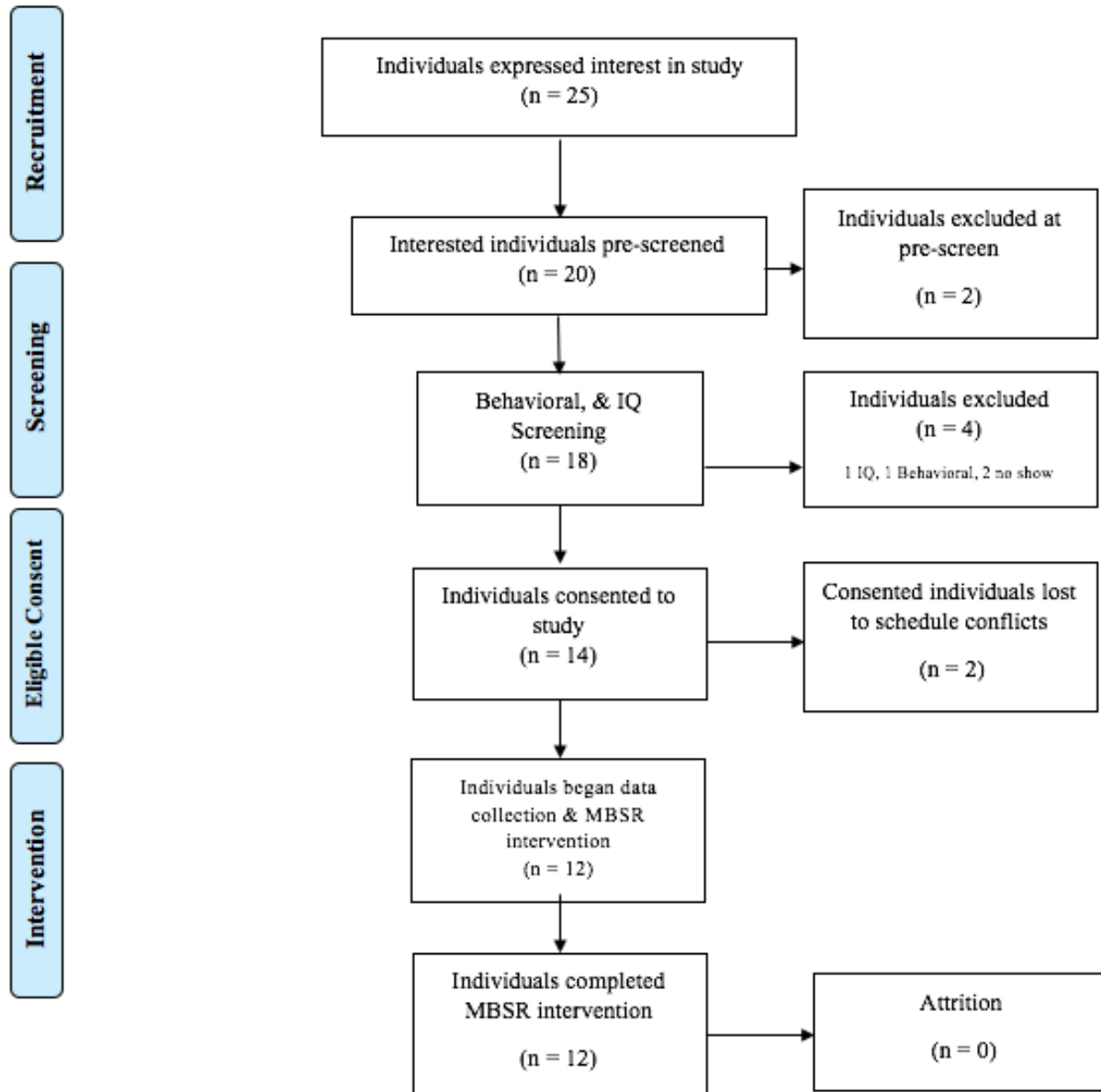


Figure 3. MBSR feasibility trial recruitment and retention

5.3.2.2 Acceptability of Intervention

There were no adverse events that occurred during this study.

Understanding scores from the UOMS were dichotomized into understanding (3 or 2) and lack of understanding (1) and examined with descriptive statistics. All participants received understanding scores (2 or higher) for every session attended. Thus, research question 2, (Will 80% of enrolled participants receive understanding scores for 85% of the sessions?) was met.

Understanding scores per session were also examined descriptively and results presented in Table 5 below. There were several participants who received understanding scores of 2 (some understanding) throughout the intervention. Specifically, 25% of the sample received ‘some understanding’ ratings in session 3, and 30% of participants received ‘some understanding’ for session 7. Understanding scores were not recorded for the 7.5-hour all-day silent meditation retreat, as it was not possible for the teacher to rate understanding of material without verbal communication. See Table 5 below for understanding statistics.

Participant engagement in each group session were examined using the Pittsburgh Rehabilitation Participation Scale (PRPS), with scores ranging from 1 - 6. Scores on the PRPS were dichotomized into engagement and lack of engagement. Scores of 4, 5, or 6 indicated adequate engagement. Scores of 1, 2, or 3 indicated lack of engagement. All participants received engagement scores (4 or higher) for sessions 2-8 and the silent retreat. One participant received a score of 3 in session 1, indicating lack of engagement in the dichotomized schema. Participant engagement was also examined descriptively, with means ranging from 5.62 - 6 ($SD=.35 - 1.06$). Mean engagement and understanding scores were positively correlated with each other ($r=.707$). See Table 5 below for engagement statistics.

Table 5: Understanding and engagement descriptive statistics by session

Session #	Understanding dichotomized (%)	Some Understanding-2(%)	Understanding Mean (SD)	Engagement dichotomized (%)	Engagement Mean (SD)
1	100%	8.3%	2.87 (.35)	91.67%	5.62 (1.06)
2	100%	18.2 %	2.75 (.46)	100%	5.75 (.46)
3	100%	25%	2.87 (.35)	100%	5.75 (.46)
4	100%	10%	2.88 (.35)	100%	5.87 (.35)
5	100%	8.3%	2.92 (.288)	100%	5.75 (.46)
6	100%	8.3%	2.87 (.35)	100%	5.87 (.35)
7	100%	30%	2.75 (.46)	100%	5.75 (.46)
8	100%	9.1%	2.91 (.30)	100%	6
Retreat	N/A	N/A	N/A	100%	6

Participants rated satisfaction with the intervention with the Client Satisfaction Questionnaire (CS-8), in which scores can range from 8-32. Study participants' satisfaction scores ranged from 23-32 with a mean of 27.9 ($SD= 3.47$). Results suggest that the intervention was acceptable to the participants, as the study sample reported high satisfaction.

5.3.3 Research Question 2: MBSR Fidelity and Integrity

5.3.3.1 MBI-TAC Fidelity Ratings

Intervention fidelity and integrity were evaluated using the MBI-TAC. Scores range from 1 (incompetent) to 6 (advanced). Two weekly sessions were randomly selected for review. An expert MBSR teacher and researcher reviewed session agendas, notes, audio recordings, and the session transcription. Sessions 4 and 5 were randomly selected for intervention fidelity and integrity review. Session 4 fidelity was met with overall rating of "proficiency +" ($M=5.33$; $SD=.5$). Domain specific competency ratings for session 4 ranged from 5 (proficient) to 6 (advanced). Session 5 fidelity was also met with an overall competency rating of "proficiency"

($M=4.67$; $SD=.5$). Domain specific competency ratings for session 5 ranged from 4 (competent) to 5 (proficient). Thus, research question 3 (Did the teacher demonstrate overall teaching competency (score of 3) by the MBI-TAC standards?) was met. Table 7 below details competency ratings per domain for selected sessions.

Table 6: Sessions 4 and 5 MBI-TAC competency ratings per domain

MBI-TAC Competency Domain	Session 4	Session 5
Coverage, pacing and organization of session curriculum	5	4
Relational Skills	6	5
Embodiment of mindfulness	5	5
Guiding mindfulness practices	6	5
Conveying course themes through interactive inquiry and didactic teaching	5	4
Holding the group learning environment	5	5

5.3.3.2 Modifications Required

This study sample did not require any modifications to the standardized curriculum. All meditations were the suggested length (45 minutes) and participants completed the silent all-day meditation retreat without problems. All sessions were completed consistent with the guidelines provided by the curriculum.

There were a few adaptations required for group activities and discussions. The teacher noted that participants had difficulty sharing with each other in small groups (dyads and triads).

Traditionally, discussion questions are written on a board for the room and discussed in pairs. However, several participants had difficulty initiating conversation or contributing to small group discussions. Thus, the teacher provided participants with small pieces of paper with 3 concrete questions written on them. Questions were related to homework completion, homework challenges, and reactions to new meditation practices. Groups were structured to take turns answering each question. The teacher noted that small group discussions improved with the addition of the prompt paper. The teacher also provided a handout during the communication activity (week 6). The handout consisted of a triangle of awareness and an image of another activity used weekly. Participants were instructed to use this image to write down thoughts and reactions during a communication activity. The handouts assisted participants with organization of thoughts and reactions prior to facilitating a large group discussion. These adaptations to activities are consistent with the themes and intentions within the standardized curriculum and do not qualify as an intervention modification.

Participants requested psychoeducation on challenges specific to ASD on two occasions. During session 4, participants learned about the stress response cycle. Participants asked the teacher to explain how the stress response is different for individuals with ASD. The teacher facilitated discussion of participants' emotional reactions. Psychoeducation on emotional dysregulation was provided as well. During session 4 and 5, participants reported challenges with informal mindfulness homework practices. Participants reported being overwhelmed by too much sensory stimuli while completing a daily activity with mindfulness. Thus, psychoeducation on sensory sensitivity specific to ASD was provided. The teacher provided suggestions of using concentration practice to focus on one stimuli when overwhelmed with sensory input. In

addition, teacher facilitated discussion on monitoring sensory sensitivity and overstimulation on a daily preventative basis.

Facilitating a safe group environment, or ‘holding the container’, required additional structure that was unique to this population. This group required prompting and behavioral corrections on a weekly basis to maintain the safe group environment. For instance, participants perseverated on certain topics. The teacher would have to prompt the participant to remain in the moment and sometimes lead an impromptu breathing meditation to re-establish the group environment. In addition, some participants experienced challenges with understanding the group norms, boundaries, and lacked social skills. The teacher made behavioral corrections to a few participants at times. These corrections were delivered non-judgmentally with kindness. The teacher also explicitly explained any behavioral corrections to the group. A strategy that worked well was to explicitly review group rules and norms on a weekly basis. For instance, the teacher would mention weekly that meditations were silent aside from the teacher, to maintain personal space, no advice giving, and limit story telling.

Overall, the adaptations made for the population were consistent with the overall ethos and intention of MBSR. Table 7 below describes the adaptations made throughout the course of the 8-week intervention.

Table 7: Teaching adaptations within MBSR curriculum

Session #	ASD-specific behavior	Challenge for group	Adaptation within MBSR Curriculum	Outcome observed
All	Difficulty initiating unstructured conversations	Reflective speaking and listening in dyads was challenging and uncomfortable for participants.	Provide concrete questions on paper for use in dyad discussions.	The additional structure appeared to be helpful. Participants engaged in dyad discussions with greater comfort and made discoveries.
All	Social reciprocity	Over-sharing in group, not taking turns during large group discussions	Regular prompting of story-telling, monitoring sharing, and re-directing.	Helpful to group process.
All	Perseveration	Group member perseverating on past or excessive story telling.	Re-establishing story-telling guidelines. Stopping discussions with impromptu breathing meditation. Prompting participants of being “stuck”	This appeared to help the group progress and maintain reciprocity amongst group members.
All	Spatial awareness	Maintaining one’s space during meditations, not touching others, and talking during meditations.	Re-establish group ‘rules’ on weekly basis. Directed placement of mats and cushions in group room.	Effective in managing the group environment.
4	Requested psychoeducation on ASD specific emotional reactivity	Lack of understanding of emotional dysregulation.	Provided psychoeducation on emotional dysregulation in ASD – high reactivity and	Participants reported that this information was helpful.

Table 7 (continued)

			emotional inflexibility	
4, 5	Difficulty with sensory sensitivity during meditations.	Managing sensory sensitivity during meditations (i.e. noise)	Psychoeducation on sensory sensitivity in ASD. Provided specific meditation suggestions for times of sensitivity – anchoring to neutral area.	Participants reported that this information was helpful.
6	Abstraction	Difficulty with abstract concepts and discussions	Provided structured visual handout for communication activity.	The visual appeared to aid reflection and discussion.

5.3.3.3 Supports Required

The MBSR intervention was determined to be feasible, acceptable, and did not require any formal modifications from the standardized curriculum. However, significant supports were provided to participants that exceeded what is typically needed and provided in this intervention. The supports included additional time with the MBSR teacher, independent living skills (e.g. travel, parking), and problem solving assistance.

Independent travel and organization of time was a challenge for study participants. Several participants reported significant challenges traveling independently to study appointments. Two participants utilized caregivers or family members to transport to study appointments. On average, 5 participants were late to the start of group each week. Despite problems with timeliness, the teacher began each group at the scheduled time. One participant

attended every appointment between 20 and 60 minutes late and was 3 hours late to the full-day retreat. However, this individual attended every weekly session and the retreat day. Several participants reported challenges with the public bus transportation in relation to weekend group sessions. The weekly group sessions were held on Saturdays from 10:00-12:30pm. The all-day retreat was held from 9:00am-4:30pm. Participants reported that they were inconvenienced by the Sunday bus schedule due to the limited routes and multiple transfers.

Two participants reported challenges with homework completion, as participants were asked to complete 45 minutes of homework nightly. They reported that it was challenging to find time for this amount of homework on a regular basis. Participants were informed of this homework requirement during informed consent and orientation.

Additional time was required of the MBSR teacher before and between sessions compared to MBSR groups not specific to ASD. The teacher recorded to spend 38.75 minutes ($SD = 22.48$) with participants after group. Specifically, the following number of minutes were spent with participants after group conclusion: 75 (week 1); 30 (week 2); 30 (week 3); 60 (week 4); 40 (week 5); 30 (week 6); 0 (week 7); 45 (week 8). Challenges included the following: parking challenges, driving problems, problem solving, weather concerns bus challenges, audio recordings, and de-escalation. Two participants had difficulty transferring the mindfulness recordings to their personal listening device. Recordings were provided by CD, google drive audio links, and dropbox audio links. Assistance was also provided for parking and problem solving when the parking garage was full. Finally, one participant did require assistance purchasing a bus ticket after group, as they had attended group without financial means to return home. Time spent after groups appeared to be specific to the ASD population. Specifically,

participants with marked challenges related to verbosity, emotion regulation, organization of time, independent living skills, and problem solving required additional time with the teacher.

Several participants arrived early to weekly sessions. This was a concern, as the building was not open to participants prior to teacher arrival. Thus, the teacher was required to arrive between 60 and 90 minutes early for group. The teacher would open the waiting room for participants, and they waited while the teacher prepared the room and group environment. This appeared to be related to participants' rigidity with schedules and public transportation challenges.

The teacher received, on average, 4 calls weekly from participants between sessions. Calls consisted of concerns related to the following: weather, personal challenges, difficulty with the audio recording transfer, and study assessment appointments. Several of these calls appeared to be specific to the ASD population (problem solving and independent living skills).

The research assistant assisted a few participants with the use of the WePay card. This assistance consisted of walking the participants to the bank and helping them withdraw the money. These challenges appeared to be specific to the ASD population as well (problem solving and independent living skills).

5.3.4 Research Question 3: Effect Size Estimates

A one-way within subjects analysis of variance was performed on SWLS scores as a function of change over time. The within-subjects independent variable was time with 3 levels (baseline, mid, and post). Assumptions of normality were met for all cells. Descriptive statistics did not show any major outliers or severe violations from normality. The assumption of sphericity was met, Mauchly's $W = .877$, $p = .519$. Participants' improved satisfaction with life scores trended

towards significance across time, $F(2) = 3.22$, $p=.059$, with a large effect size of *partial* $\eta^2 = .227$ (Table 8). The magnitude of change (Cohen's d) was calculated between time points. There was no effect of change in life satisfaction between pre and mid assessments ($d = .079$). Small effect size improvements in life satisfaction occurred between mid-post ($d = .27$) and pre-post ($d = .35$) assessments. See table 9 below for effect sizes by time point.

A one-way within subjects analysis of variance was performed on CAMM scores as a function of change over time. The within-subjects independent variable was time with 3 levels (baseline, mid, and post). Assumptions of normality were met for all cells. Descriptive statistics did not show any major outliers or severe violations from normality. The assumption of sphericity was met, Mauchly's $W = .706$, $p=.176$. Participants' mindfulness scores trended towards significance across time, $F(2) = 3.34$, $p=.054$, with a large effect size of *partial* $\eta^2 = .233$ (Table 8). The magnitude of change (Cohen's d) was calculated between time points. There was no effect of change in mindfulness between pre and mid assessments ($d = .14$). Small effect size improvements in mindfulness occurred between mid and post assessments ($d = .47$). Overall, there was a medium effect size magnitude of change in mindfulness scores between pre and post assessments ($d = .60$). See table 9 below for effect sizes by time point.

A one-way within subjects analysis of variance was performed on HEAL Positive Outlook scores as a function of change over time. The within-subjects independent variable was time with 3 levels (baseline, mid, and post). Assumptions of normality were met for all cells. Descriptive statistics did not show any major outliers or severe violations from normality. The assumption of sphericity was met, Mauchly's $W = .936$, $p=.724$. Participants' positive outlook scores significantly differed across time, $F(2) = 12.42$, $p<.001$, with a large effect size of *partial* $\eta^2 = .530$ (Table 8). Subsequent simple comparisons examined through post hoc Bonferroni

testing indicated a significant difference in positive outlook between baseline and post, $p=.006$, as well as between mid and post assessments, $p<.001$. The magnitude of change (Cohen's d) was also calculated between time points. Interestingly, there was a slight worsening of positive outlook between pre and mid assessments. However, changes were so small they did not constitute an effect ($d = -.084$). Medium effect size improvements in positive outlook occurred between mid - post assessments ($d = .711$) and pre - post assessments ($d = .598$). See table 9 below for effect sizes by time point.

A one-way within subjects analysis of variance was performed on Neuro-QOL anxiety scores as a function of change over time. The within-subjects independent variable was time with 3 levels (baseline, mid, and post). Assumptions of normality were met for all cells. Descriptive statistics did not show any major outliers or severe violations from normality. The assumption of sphericity was not met, Mauchly's $W = .519$, $p=.038$, so the Greenhouse-Geisser correction was used. Participants' anxiety scores did not significantly differ across time, $F(2) = .4$, $p=.598$, with a small effect size of *partial* $\eta^2 = .035$ (Table 8). There was a slight worsening of anxiety between pre and mid assessments. However, changes were so small they did not constitute an effect ($d = .077$). Small effect size improvements in anxiety occurred between mid and post assessments ($d = -.218$). Overall, there was no change between pre and post assessments ($d = -.114$). See table 9 below for effect sizes by time point.

Total scores for the WHOQOL-BREF-ID were calculated by summing the mean domain scores. A one-way within subjects analysis of variance was performed on WHOQOL-BREF scores as a function of change over time. The within-subjects independent variable was time with 3 levels (baseline, mid, and post). Assumptions of normality were met for all cells. Descriptive statistics did not show any major outliers or severe violations from normality. The assumption of

sphericity was met, Mauchly's $W = .673$, $p = .138$. Participants' quality of life scores trended towards significance across time, $F(2) = 3.09$, $p = .066$, with a large effect size of *partial* $\eta^2 = .219$ (Table 8). The magnitude of change (Cohen's d) was calculated between time points. There was a small magnitude of change in quality of life between pre and mid assessments ($d = .217$). There was no effect of change in quality of life between mid and post assessments ($d = .155$). Overall, there was a small effect size magnitude of change in quality of life scores between pre and post assessments ($d = .352$). See table 9 below for effect sizes by time point.

A one-way within subjects analysis of variance was performed on WHOQOL-DIS-ID scores as a function of change over time. The within-subjects independent variable was time with 3 levels (baseline, mid, and post). Assumptions of normality were met for all cells. Descriptive statistics did not show any major outliers or severe violations from normality. The assumption of sphericity was met, Mauchly's $W = .637$, $p = .105$. Participants' disability impact scores did not significantly differ across time, $F(2) = 1.73$, $p = .2$, with a medium effect size of *partial* $\eta^2 = .136$ (Table 8). There was a slight worsening of disability impact between pre and mid assessments. However, changes were so small they did not constitute an effect ($d = -.156$). Small effect size improvements in disability impact occurred between mid - post assessments ($d = .423$) and pre - post assessments ($d = .202$). See table 9 below for effect sizes by time point.

Table 8: Results of one-way within subjects ANOVA

Measure	Pre <i>M (SD)</i>	Mid <i>M (SD)</i>	Post <i>M (SD)</i>	<i>p-value</i>	<i>Power</i>	<i>Effect Size</i> <i>partial η^2</i>
SWLS	22.5 (6.4)	23 (6.2)	24.58 (5.5)	.059	.97	.227
CAMM	19.1 (9.0)	20.3 (7.9)	23.5 (5.3)	.054	.98	.233
HEAL	20.0 (4.9)	19.6 (4.6)	22.7 (4.1)	<.001*	1.0	.530
Neuro-QOL	20.8 (7.5)	21.3 (5.4)	20.0 (6.5)	.598	.25	.035
Anxiety						
BREF-ID	59.9 (9.0)	61.7 (7.5)	62.9 (8.0)	.066	.97	.219
DIS-ID	43.1 (9.9)	41.7 (8.0)	44.8 (6.6)	.2	.81	.136

Bold = large effect size (*partial $\eta^2 \geq$*); * = statistical significance ($p < .05$)

Table 9: Effect size (Cohen's *d*) by time point

Measure	Pre-Mid	Mid-Post	Pre-Post
SWLS	.079	.27	.349
CAMM	.142	.476	.596
HEAL	-.084 ^a	.711	.598
Neuro-QOL	.077 ^a	-.218	-.114
Anxiety			
BREF-ID	.217	.155	.352
DIS-ID	-.156 ^a	.423	.202

^a Change occurred in the wrong direction.

Bold = medium effect size ($d = .5, .79$)

5.3.5 Exit Interviews

Each participant completed an exit interview with a trained research assistant. The exit interview was audio recorded and transcribed for future qualitative analyses. Participants were asked to reflect on the daily impact, insights, benefits, and problems incurred while participating in this research study. Responses to the exit interviews were varied and a full qualitative analysis is warranted.

Participants described the MBSR interventions with the following descriptors: awareness, weekly commitment, basic – intermediate advice on handling stress, helps you control emotions, self-care focus, helps calm down, mental stress reduction that is helpful to deal with anxiety, really helpful, and handling stressors.

When asked to describe benefits, seven participants listed emotion regulation. This was described with several phrases, including: less meltdowns, calm myself faster, calm myself with breathing, helps calm down, nicer person, controlling emotions, and overcoming my situations. Participants also reported benefits in increased awareness, understanding multiple perspectives; self-esteem, social benefits from group, better life outlook, and the ability to problem solving rather than freezing under stress.

Two participants reported problems with transportation and attendance to group. Two individuals reported difficulty accessing meditation recordings. Five individuals mentioned challenges completing the homework and feelings of stress or guilt when unable to complete homework every night.

Participants reported impact in their daily lives in areas of self-esteem, less stress, more confidence, better focus, more present, more stable, better sleep, feeling comfortable with self, and more productive. Several participants mentioned improvements in confidence and self-

esteem. A few participants quoted the phrase “there is more right with you than wrong with you” as a new motto or internal dialogue script during stress.

Several participants reported to learn more about their personal limits and reported that they started making choices of self-care. Three participants mentioned improvements in self-esteem, specifically “I also learned I am a worthwhile person” and “It made me feel like I’m more human even though I’m not perfect”. A few individuals reported learning to focus better. Other reports include:, control my temper, be gentle to myself, see things from other perspectives, and managing stress.

Overall, exit interviews suggest meaningful change in the areas of self-esteem, emotion regulation, and stress management. Emotion regulation and poor self-esteem are common challenges for adults with ASD. Future research should collect data on these outcomes. Exit interviews also suggested that MBSR helped with rumination and dwelling on the past. This is a possible explanation for the lack of change in anxiety symptoms, as the sample may experience more perseverative thinking or rumination than traditional generalized anxiety. Participants cited challenges related to transportation and amount of homework. It should be noted that participant compliance with homework was exemplary. It is possible that homework completion was interpreted by many members as a concrete rule due to limitations in flexible thinking.

5.4 LIMITATIONS

This research study had some methodological limitations worth considering. The sample size of this research study was small (n=12). The sample size of this study was appropriate for a preliminary feasibility study but limits the generalizability of the results. The sample comprised

of adults with ASD but excluded for intellectual disabilities. Thus, additional studies are needed to determine appropriateness for individuals with lower verbal abilities.

The teacher of the intervention completed all participant engagement and understanding ratings using the PRPS and UOMS. This could have been strengthened with multiple raters, as the teacher may have been biased in the interpretations. However, it is recommended that raters would need to be familiar with both the MBSR intervention and the ASD population. Further, the UOMS has not undergone validation studies. More research is needed on this clinical rating scale to determine its ability to reliably detect participant understanding of intervention material.

This study only collected a select number of self-report outcomes. It is possible that the full extent of MBSR's benefits for this population was not captured with the selected instruments. Future studies should consider collected data on rumination, emotion regulation, and depressive symptoms. Study 1 of this research project suggested that the WHOQOL-BREF-ID and WHOQOL-DIS-ID domain factors were possibly inappropriate instruments for this population. Participants in this study also reported difficulty completing item 21 (satisfaction with sexual activity) to the research assistant. This study found medium effect size improvements in QOL using the WHOQOL-BREF-ID. The WHOQOL-BREF-ID violated assumptions of normality when analyzed by domain. However, both instruments met assumptions of normality when analyzed as total scores. It is possible that these results are spurious due to an inappropriate instrument for this population.

Transportation challenges reported in this study could be specific to this city. Two participants did not begin research procedures due to time and transportation constraints. Scheduling the group was difficult due to varying work schedules and limitations to public transportation during weeknights. Thus, a weekend group was chosen to accommodate as many

schedules and transportation challenges. Several of the missed sessions were due to weekend commitments. It is possible that participants would have experienced less challenges to attending the groups in a different city or location.

5.5 DISCUSSION

This is the first study to evaluate the feasibility and acceptability of MBSR for adults with ASD. Many researchers have evaluated the use of mindfulness-based interventions or mindfulness skills practice with an adult ASD population. However, evidence consistently shows that the formal 8-week mindfulness interventions (MBCT and MBSR) are more effective than mindfulness skills or meditation exercises. Many researchers have adapted mindfulness interventions for this population without first determining if adaptations and modifications were necessary. This study evaluated a group MBSR intervention for adults with ASD without modifications. Careful monitoring ensued in the event that modifications were required throughout the study. However, this research study established preliminary feasibility of a MBSR group intervention for adults diagnosed with ASD.

Recruitment was a challenge for this study. Future studies should account for long periods of recruitment to recruit a large enough group to begin together. Scheduling the group was also a challenge due to public transportation issues in this community. Future studies should consider limitations in independent living skills as a feasibility factor for attendance and scheduling. It should be noted that the study has continued to attract interest in the local ASD community, as there are eight adults with ASD on the waiting list for future MBSR groups.

Despite the small sample size, the study sample had an adequate range of ages (22-63) and IQ scores (FSIQ= 76-127). The sample was representative of population gender statistics for ASD (1:4 female to male ratio), as 25% of the study sample was female. The sample consisted of mostly Caucasian individuals, which is also representative of the ASD population. Although the sample was too small to generalize results, the study sample was reflective of population

estimates. All participants were new to MBSR, as none reported to take a previous meditation class or had a regular meditation practice.

Retention rates of this study were excellent, as there were no drop-outs and all participants completed the post assessments. All participants completed the required dosage, 5 of 8 weekly sessions. Further, the sample reported high satisfaction with the intervention at post-assessments. There were no adverse events that occurred during the course of treatment. Thus, MBSR proved to be feasible, satisfying, and tolerable for this study sample.

Participant understanding and engagement were also excellent for this study. Participants all received understanding ratings and high engagement scores throughout the intervention. Given the range of intelligence scores in the sample, these results suggest that understanding of the material was not dependent on intellectual functioning. The participants reported to complete their homework each week, which is often cited as a necessary agent of change in MBSR. These results suggest that MBSR is acceptable for adults with ASD.

Intervention fidelity and teacher competency was established in this study as well. The teacher followed the standardized curriculum while maintaining authenticity and responding in the moment to group needs. There were no modifications required for this study sample. Adaptations were made to small and large group discussions in order to better facilitate discussion between group members. The teacher provided prompt sheets to participants with concrete discussion questions to share with fellow group members. This accommodation helped support the group process. Behavior prompting was required of the teacher at times for group disruption, perseveration, maintaining personal space boundaries, and turn taking. The group did request the teacher to explain emotional dysregulation specific to ASD during week 4 discussion of stress reactivity. Thus, the teacher explained reactivity specific to ASD during this session.

Reactivity was explained in terms of high reactivity and emotional inflexibility. The group also required ASD specific information related to sensory sensitivity. This often was reported during meditations. The teacher incorporated this into discussions related to shifting focus to one central stimuli rather than choiceless observance of all sensory input. These discussions were specific to challenges encountered by individuals with ASD. It is possible that these topics were requested because the participants knew this research study was specific to ASD. It is possible that these discussions would not occur in a traditional heterogeneous MBSR group. However, participants reported gratitude for this information. Skillful in-the-moment adaptations to the group are a part of all MBSR teaching and not specific to this study or population. The adaptations made in this study were consistent with MBSR teaching and curriculum.

It should be noted that although adaptations were within the MBSR curriculum, the study sample required additional supports from the teacher and research assistants that exceed what is typically provided in MBSR. Participants also required that the teacher would arrive to group several hours early due to transportation challenges and rigidity to scheduling. Independent travel and problem solving was problematic for participants. For instance, participants required additional assistance with parking, planning homework, using the audio recordings, and problem solving. These supports were in areas of deficits related to ASD. Specifically, individuals with ASD have challenges in problem solving, independent living skills, and organization of time. Participants required, on average, 30 minutes of additional assistance from the teacher after class. This was often due to perseveration on topics discussed during class and assistance with how to apply mindfulness to their daily challenges. These supports were critical to the success of the intervention and should be factored into feasibility when providing MBSR groups for this population in the future.

There were strengths and limitations to the homogeneity of this study sample. This allowed participants to discuss challenges specific to their disability. This allowed the teacher to assist with better generalization of the class topics to everyday lives. However, limitations in social skills and group behaviors were amplified due to the homogeneous group. A few participants reported to have frustrations with group behaviors and lack of reciprocity during discussions in their exit interview.

Findings suggest that MBSR may be an effective intervention for adults with ASD. Positive outlook, satisfaction with life, mindfulness, and quality life all changed over time, with large effect sizes ranging from *partial* $\eta^2 = .227$ to $.530$. These results are promising given the small sample size ($n=12$). Interestingly, anxiety was the only construct that did not change over time.

Positive outlook significantly improved over time ($p<.001$) with large effects averaged across time (*partial* $\eta^2 = .530$). Effect sizes indicate that participants reported a medium magnitude of change between pre and post assessments ($d=.598$). Life satisfaction ($p=.054$) approached statistical significance in improvement averaged across time (*partial* $\eta^2 = .227$). Similarly, the WHOQOL-BREF-ID trended towards statistical significant improvements averaged across time (*partial* $\eta^2 = .219$, $p=.066$). The HEAL Positive Outlook scale contains items related to coping, life satisfaction, confidence, and outlook of future. The SWLS contains items related to life satisfaction, regret, and life conditions. Life satisfaction is a similar construct to QOL. However, QOL can be conceptualized to include satisfaction with life along with other domains (physical health, psychological health). Thus, it is unsurprising that the HEAL Positive Outlook Scale correlated with the SWLS scale ($r=.707$) and WHOQOL-BREF-ID ($r=.580$) were correlated with each other. This suggests that these measures are all detecting similar changes in

study participants. Participants experienced an improvement in subjective evaluation of their QOL and life outlook.

Analyses also detected a large effect size increase in mindfulness across time (*partial* $\eta^2 = .233$) that trended towards statistical significance ($p = .054$). This suggests that participants learned the target construct of mindfulness throughout the intervention. Identifying mechanisms of change is outside the scope of this feasibility study. However, future studies may want to evaluate if changes in mindfulness predict changes in QOL, life satisfaction, or positive outlook.

The lack of change in anxiety symptoms is surprising given the changes in positive outlook, life satisfaction, QOL, and mindfulness. The Neuro-QOL Anxiety measure was inversely related with the other measures, as correlations with other outcome measures ranged from $r = -.331$ (SWLS) to $r = -.609$ (WHOQOL-BREF-ID). There are several possible explanations for the lack of change detected in anxiety symptoms. This was an underpowered feasibility study and *a priori* power analyses indicated that effect sizes smaller than $d = .8$ would not be detectable. In addition, anxiety scores were not significantly elevated at baseline ($M = 20.8$, $T\text{-score} = 55$) despite several comorbid anxiety disorder diagnoses. It is possible that the Neuro-QOL Anxiety Form is an inappropriate measure for this population. The scale had acceptable internal consistency at baseline ($\alpha = .897$), but further research is needed to formally evaluate the psychometrics of this scale in an adult ASD population. It is possible that the anxiety items on the form did not relate to the challenges experienced by this study sample. Some items on the Neuro-QOL Anxiety Form could be related to other constructs that are common challenges in this population. For instance, “I had difficulty calming down” and “I felt nervous when my routine was disturbed” could be related to emotional regulation and inflexibility for ASD rather than traditional anxiety. Finally, it is possible that anxiety was not a relevant outcome of this

intervention for this population. Participants reported meaningful changes in other areas during qualitative exit interviews. It is possible that generalized anxiety was not a problem for this study sample.

In conclusion, this study establishes preliminary feasibility of MBSR for adults with ASD. Retention rates, satisfaction with the intervention, participant engagement, and understanding of the intervention were excellent. Intervention fidelity and teacher competency were established. Participants reported challenges with transportation and homework completion. Estimates of effect sizes indicated large changes over time in mindfulness, satisfaction with life, positive outlook, and QOL. There were no improvements in anxiety over the course of the study. Exit interviews suggest that emotion regulation, self-esteem, and stress management were impacted through this intervention. It is suggested that future studies incorporate these constructs as target outcomes. This sample size consisted of individuals diagnosed with ASD with the exclusion of Intellectual Disabilities (ID). Thus, conclusions are not generalizable to individuals with lower IQ than this study sample. Future pilot studies are needed to replicate results, identify additional target outcomes, and identify mechanisms to change.

6.0 CONCLUSIONS AND FUTURE WORK

6.1 CONCLUSIONS

This research project evaluated the feasibility of assessing psychosocial self-report outcomes and conducting a group MBSR intervention with adults diagnosed with ASD. Study 1 evaluated selected mindfulness (CAMM) and QOL measures (SWLS, WHOQOL-BREF, & WHOQOL-DIS) with a sample of twenty-two adults with ASD. Study 2 consisted of a feasibility trial of a group MBSR intervention with twelve adults diagnosed with ASD. This research project found that cognitive deficits specific to ASD are likely impact the interpretation of self-report assessments that are developed and validated with neurotypical populations. Scales that were evaluated in disability populations (WHOQOL-DIS) do not necessarily translate to being understandable and appropriate for the ASD population either. Challenges in self-report assessments create implications for selecting target outcome measures and the capacity to capture change in intervention trials. Results across both studies suggest that traditional self-report assessments may pose challenges for this population. Despite these challenges, this research project established preliminary feasibility for utilizing MBSR as a group intervention for adults diagnosed with ASD.

Research study 1 found that the CAMM and SWLS are appropriate self-report measures for this population. Results indicated that the WHOQOL-BREF, WHOQOL-DIS are problematic

for this population. Alternative versions of those scales, the WHOQOL-BREF-ID and WHOQOL-DIS-ID included item revisions that were better understood by this study sample. Despite the modified language in these scales, the WHOQOL-BREF-ID and WHOQOL-DIS-ID also demonstrated problematic factor structures with this study sample. Factors related to social relationships were most problematic to subjects, which is reflective of social deficits experienced with ASD. Individuals with ASD experience cognitive deficits in abstraction, flexible thinking, and awareness. These challenges were judged to contribute to concrete interpretation of items on the WHOQOL-BREF-ID and WHOQOL-DIS-ID. Thus, researchers may want to search for QOL measures that are more appropriate for individuals with ASD. Researchers may also want to consider developing a QOL measure specific for this population, as the ID versions of the WHOQOL scales did not address the problems associated with ASD. Given the selected sample used in this study, the results should be replicated with larger community samples.

MBSR is a group intervention that has shown promising results in improving QOL, life satisfaction, stress, and attentional control. MBSR has never been applied to individuals with ASD despite potential benefits in areas of limitations for this population. This is the first study to evaluate the feasibility of MBSR for adults diagnosed with ASD. The study established preliminary feasibility of utilizing MBSR with an adult ASD population, as retention rates, participant engagement, and understanding of the intervention were all excellent. The trial also met standards for fidelity and teacher competency. Adaptations to the MBSR curriculum were made to meet the needs of this group. Specifically, participants required assistance structuring discussions, maintaining appropriate behaviors, and psychoeducation on ASD-specific symptoms was provided. All adaptations made were within the accepted flexibility of the standardized MBSR curriculum.

Analyses revealed large effect sizes changes in mindfulness, satisfaction with life, positive outlook, and QOL following the MBSR intervention. Interestingly, there were no changes in anxiety symptoms throughout the study. These results were surprising given that the CAMM, SWLS, HEAL Positive Outlook scale, and WHOQOL were all inversely related to the NeuroQOL-Anxiety ($r=-.331$, $r=-.631$). Of note, anxiety symptoms were not significantly elevated at baseline. Further research is needed to determine if the Neuro-QOL Anxiety scale is appropriate for this population. It is possible that items related to routine (item 8) and calming down (item 6) overlap with emotional regulation and inflexibility. Cognitive inflexibility often presents itself as rigidity to routine and negative reactions to change. In addition, emotional dysregulation in ASD is characterized by difficulty calming down. Thus, these items could overlap with additional functional limitations in ASD rather than being specific to anxiety. Qualitative exit interviews suggest that participants benefited from improvement in self-esteem, rumination, emotion regulation, and stress management. Multiple participants endorsed benefits and daily impact in these areas. Future studies should incorporate these constructs as target outcomes in addition to analyzing the NeuroQOL Anxiety scale.

The scales that were determined appropriate and reliable for this population (CAMM, SWLS) in Study 1 demonstrated large effect sizes of change in Study 2 (*partial* $\eta^2=.233$, *partial* $\eta^2=.227$). This suggests that results were not spurious. The feasibility study detected large improvements over time in QOL, measured by the WHOQOL-BREF-ID and WHOQOL-DIS-ID. However, these scales demonstrated problematic factor structure and internal consistency in study 1. Thus, these results may be spurious due to an inappropriate instrument for this population. As noted above, additional research is needed to evaluate these QOL scales as well as the NeuroQOL Anxiety form.

Results of this research project emphasize the importance of identifying appropriate outcome measures, as self-report assessment is a challenge in this population. Individuals with ASD can accurately self-report on psychosocial outcomes. However, most scales are developed for neurotypical populations and the items can be misinterpreted due to cognitive limitations specific to ASD. The cognitive interview procedures utilized in this research project produced much insight related to item understanding, item interpretation, and formulation of answers. Researchers may want to consider incorporating this methodology step in their designs prior to utilizing self-report assessments in large clinical trials. Further, the qualitative exit interview provided much insight on changes and benefits encountered during the feasibility trial. Many of the reported learning outcomes, benefits, and daily impact were in areas not measured with the selected quantitative measures. Further, self-report measures in self-esteem and locus of control are limited. Thus, future research is needed to identify appropriate measures to capture the benefits that these study participants reported.

Overall, this research project established the feasibility of utilizing the CAMM and SWLS as outcome measure for adults with ASD. This research project also established the feasibility, safety, and tolerance of a group MBSR intervention for adults with ASD. Interestingly, the study did not conclude that formal, structural modifications are needed for this population, but that the MBSR curriculum is appropriate and contains enough teaching flexibility for use with this population. Significant additional supports were imperative to the success of this intervention and should be considered in feasibility considerations for future trials.

Perhaps the most important results of this research project are the promising effect sizes in improved QOL, mindfulness, and positive outlook. This evidence suggests that this intervention may be efficacious in improving the lives of adults with ASD. Participants listed

numerous benefits from this intervention that impacted their lives in global and daily ways. Every participant indicated that they would consider attending another MBSR intervention if given the opportunity. Participants' satisfaction with the intervention and qualitative reports of the impact suggest that this intervention produces meaningful clinical changes in self-esteem, emotion regulation, and life satisfaction.

6.2 FUTURE WORK

Future research is warranted for identifying appropriate self-report assessments for this population. This is imperative for tracking outcomes to clinical interventions. Individuals with ASD have cognitive deficits in areas of flexible thinking, abstraction, and self-awareness. Thus, it is important to evaluate the understanding of items of self-report assessments with this population. Future work will include identifying a QOL measure that is appropriate for ASD. Formal evaluation of outcome assessments is needed prior to beginning a larger clinical trial.

This research study was the first to examine the feasibility of MBSR for adults with ASD. Results of this study support the feasibility, safety, and tolerance of MBSR with this population. Adults with ASD have limited services available, as the field has shifted towards early intervention. Traditional social skills interventions do not target QOL, satisfaction, emotion regulation, or self-esteem (Palmen et al., 2012). Qualitative interviews following the intervention suggest that these are meaningful areas for change in this population. Future pilot studies with larger sample sizes are needed to replicate results, identify additional target outcomes, and identify mechanisms to change. Ideally, the pilot study would include a waitlist control group to

strengthen methodology. Recruitment for this research study stimulated a waiting list of 8, suggesting that the community has interest in this type of intervention. The results suggest that additional variables should be evaluated in subsequent trials. Finally, a full qualitative analysis of the exit interviews is warranted to determine the best target outcomes for subsequent pilot studies utilizing MBSR in adult ASD samples. Participants' reports suggest that emotion regulation, self-esteem, coping, rumination, and stress management could be explored as future constructs of interest.

APPENDIX A: ITEM ANALYSIS QUESTIONNAIRE

Please rate the following statements on a 4-point scale:

0 – *Not at all* 1 – *A little bit* 2 – *Quite a bit* 3 – *Very Much*

The questions were easy to understand	0	1	2	3
The wording of the questions made sense to me.	0	1	2	3

APPENDIX B: EXIT INTERVIEW

Initial Context:

If you were to have a conversation with a person with Autism Spectrum Disorder who is considering this Mindfulness program...

1. What would you tell them about the Mindfulness program?
 - a. *Follow up if they only give concrete answers related to the group time commitment, structure, and not the impact of the group. What impact did this group have on you?*
2.
 - a. What benefits did you experience as a result of this group?
 - b. What problems did you experience as a result of this group?
3. How did this group impact your daily life?
 - a. *Follow up if they only give concrete answers related to going to the group and not the impact of the group in their life. How were you able to use mindfulness at home or work?*
4. What did you learn about yourself as a result of this group?

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